FAR WEST TEXAS WATER PLAN

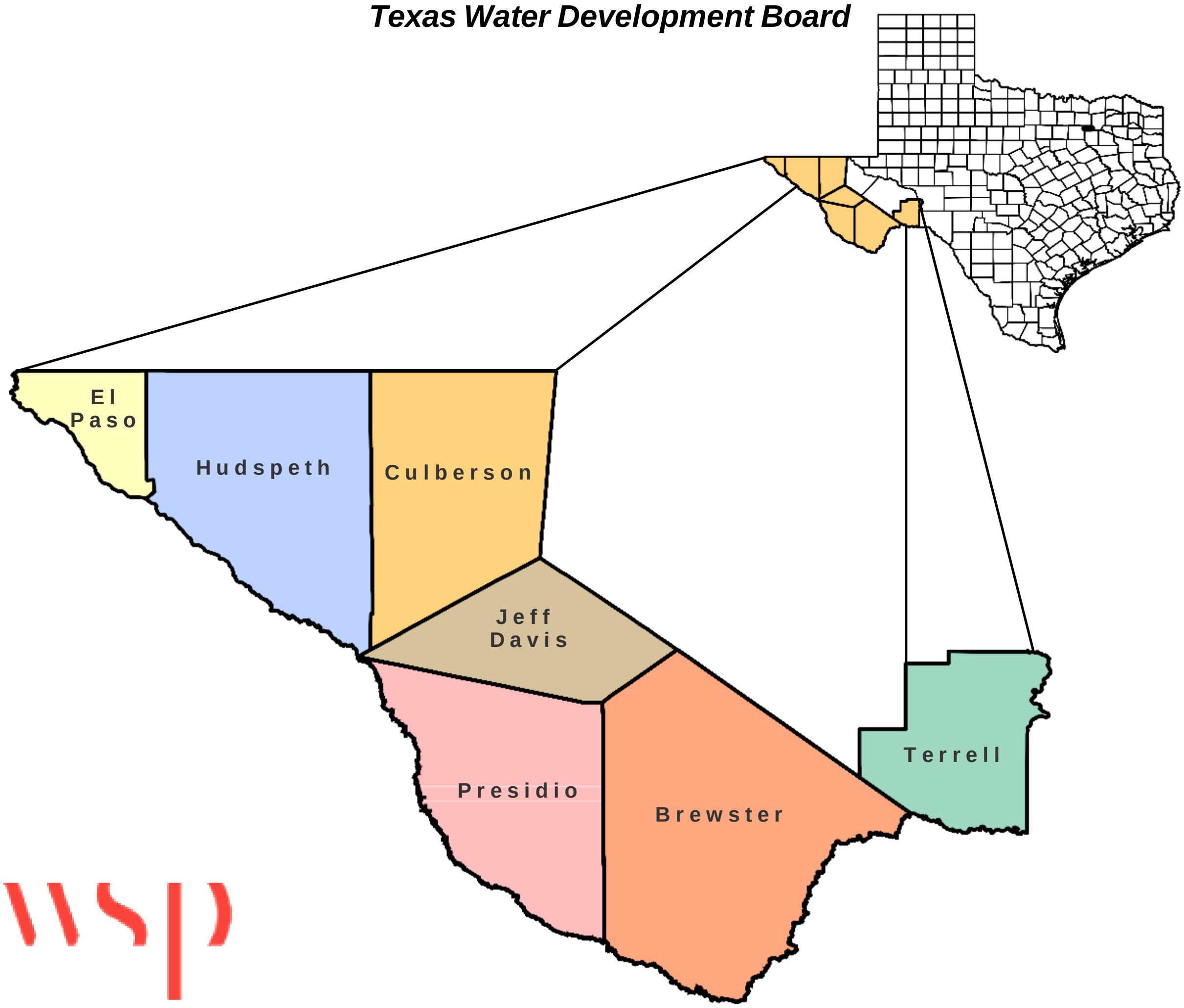
January 2021

Prepared by

Far West Texas Water Planning Group

Prepared for

Texas Water Development Board



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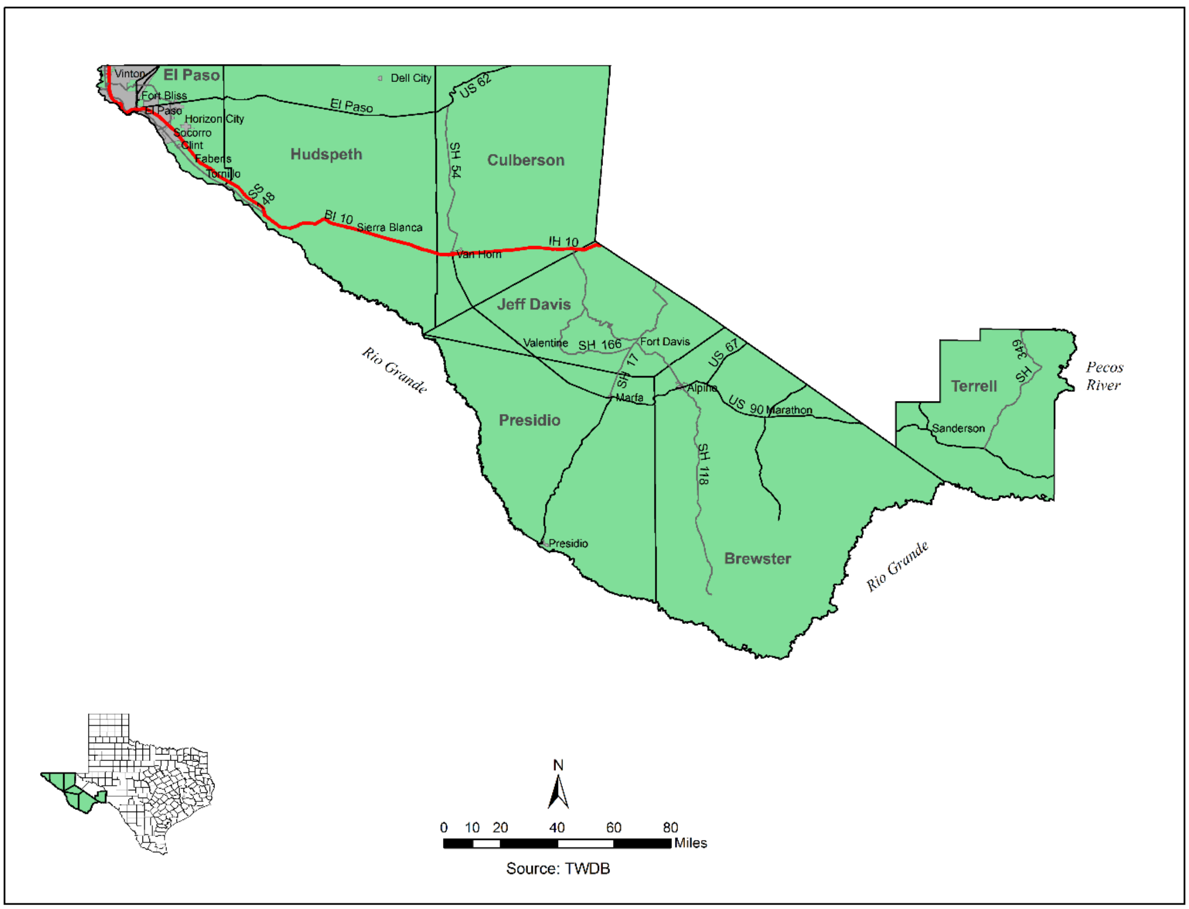
EXECUTIVE SUMMARY

Far West Texas encompasses the most arid region of the State of Texas. Residents of this expansive desert environment recognize that water is a scarce and valuable resource that must be developed and managed with great care to ensure the area's long-term viability. The Region's economic health and quality of life are dependent on a sustainable water supply that is equitably managed.

Far West Texas is bounded on the north by New Mexico, on the south and west by the Rio Grande and the United Mexican States, and on the east by the Pecos River and incorporates the counties of Brewster, Culberson, El Paso, Hudspeth, Jeff Davis, Presidio and Terrell, all which lie solely within the Rio Grande River Basin. These counties claim some of the most impressive topography and scenic beauty in Texas. The Region is home to the Guadalupe Mountains National Park, Big Bend National Park, and the contiguous Big Bend Ranch State Park. El Paso, the largest city in the Region, is also the nation's largest city on the U.S.-Mexico border. Ciudad Juarez, with an estimated population of over 1.5 million, is located across the Rio Grande from El Paso, and shares the same water sources with El Paso.

Figure ES-1. Far West Texas Region Water Planning Area Map



In January of 2016, the fourth round of regional water planning was concluded with the adoption of the *2016 Far West Texas Water Plan*. It is understood that this *Plan* is not a static plan but rather is intended to be revised as conditions change. For this reason, the current *2021 Far West Texas Water Plan* put forth in this document is not a new plan, but rather an evolutionary modification of the predecessor *Plan*. Only those parts of the original *Plan* that require updating, and there are many, have been revised.

The purpose of the *2021 Far West Texas Water Plan* is to provide a document that water planners and users can reference for long- and short-term water management recommendations. Equally important, this *Plan* serves as an educational tool to inform all citizens of the importance of properly managing and conserving the delicate water resources of this desert community.

The *2021 Far West Texas Water Plan* follows an identical format as the plans prepared by the other 15 water planning regions in the State as mandated by the Texas Legislature and overseen by the Texas Water Development Board. The *Plan* provides an evaluation of current and future water demands for all water-use categories, and water supplies available during drought-of-record conditions to meet those demands. Where future water demands exceed an entity's ability to supply that need, water management strategies are considered to meet the potential water shortages. Water management strategies are also presented that reflects an entity's desire to upgrade their water supply system. In all cases, conservation practices are first considered in managing water supplies.

Because our understanding of current and future water demand and supply sources is constantly changing, it is intended for this *Plan* to be revised every five years or sooner if deemed necessary. This *Plan* fully recognizes and protects existing water rights, water contracts, and option agreements, and there are no known conflicts between this *Plan* and plans prepared for other regions.

POPULATION AND WATER DEMAND

Except for El Paso County, the counties of Far West Texas are among the least populated in the State. In the year 2020, approximately 97 percent (925,565) of the Region's 954,035 residents are projected to reside in El Paso County, where the population density is 914 persons per square mile. The population density of the six rural counties is 1.2 persons per square mile. Approximately 75 percent of the residents in the Region are Hispanic or Latinos.

El Paso, one of the fastest growing cities in Texas, is the largest city in the Region, with a year-2020 projected population of 734,031. This is 79 percent of the total population of El Paso County and 77 percent of the Region's total population.

The year-2020 projected county populations served by water-supply utilities (mostly representing cities) and representing county other (rural domestic) in the six rural counties are as follows: Brewster County (9,727); Culberson County (2,695); Hudspeth County (3,913); Jeff Davis County (2,398); Presidio County (8,692); and Terrell County (1,045). Population of smaller communities such as Fort Hancock, Dell City, and Valentine are included in the "County Other" (rural) population of each county.

The regional population is projected to increase to 1,551,438 by the year 2070, which is an increase of 597,403 citizens. Most of this increase (563,305) is projected to occur in El Paso County.

Total projected year-2020 water consumptive use in Far West Texas is 480,424 acre-feet. The largest category of use is irrigation (310,403 acre-feet), followed by municipalities and county-other (142,507 acre-feet), steam-electric cooling (10,545 acre-feet), mining (7,835 acre-feet), manufacturing (7,033 acre-feet), and livestock (2,101 acre-feet). Sixty-five percent of water use in the Region is by the agricultural sector in support of irrigation. Thirty percent is used by municipalities and the remaining 5 percent supports manufacturing, steam-electric generation, livestock and mining.

The potential role of conservation is an important factor in projecting future water supply requirements. In this *2021 Plan*, conservation is only included in the municipal projections as a measure of expected savings based on requirements of the State plumbing code. All other conservation practices are discussed in terms of water supply strategies and as a component of drought management plans.

Environmental and recreational water use in Far West Texas is recognized as being an important consideration as it relates to the natural community in which the residents of this Region share and appreciate. In addition, for rural counties, tourism activities based on natural resources offer perhaps the best hope for modest economic growth to areas that have seen a long decline in traditional economic activities such as agriculture and mining.

Rural communities (outside of El Paso County) are relatively small and are generally reliant on self-provided water supplies. Water demand within these communities is related directly to their population trends and is thus relatively stable or moderately increasing over the next 50 years. Projected water-demand growth for the numerous communities within El Paso County is significantly greater and thus will require a level of coordinated intercommunity planning.

Water used for agricultural irrigation in Far West Texas is significantly greater (65 percent of total) than all other water-use categories. On a regional basis, water used for the irrigation of crops is projected to remain constant over the 50-year planning horizon. However, as any irrigator can attest, climate, water availability, and the market play key roles in how much water is actually applied on a year-by-year basis.

Ciudad Juarez is located across the Rio Grande from El Paso, and currently is 100 percent dependent on the Hueco Bolson and Conejos Medanos Aquifers to satisfy all its municipal and industrial demands. With a growing population that is currently estimated to be over 1.5 million, Ciudad Juarez recognizes the limitations of the Hueco Bolson to supply future demands. In addition, plans are being developed to convert 38,000 acre-feet/year of surface water from the Rio Grande (Rio Bravo) for municipal supply use. Currently, Mexico’s allocation from the Rio Grande Project of 60,000 acre-feet/year is used for irrigated agriculture. The conversion would involve supplying wastewater effluent to farmers in exchange for surface water.

WATER SUPPLY RESOURCES

Whether it flows in rivers and streams or percolates through underground rock formations, water sustains life and thus is our most important natural resource. In the Chihuahuan Desert environment of Far West Texas, water supply availability takes on a more significant meaning than elsewhere in the State. With evaporation far exceeding rainfall, planning for the most efficient management of limited water supplies is essential.

Water supply availability from each recognized source is estimated during drought-of record conditions. This allows each entity and water-use category to observe conditions when their supply source is at its most critical availability level. Specific assumptions used in estimating supply availability are listed below:

- Except for controlled flows in the Rio Grande, very little surface water can be considered as a reliable source of supply in Far West Texas, especially in drought-of-record conditions. In this chapter, two primary surface water sources are considered, the Rio Grande and the Pecos River. Other ephemeral creeks and springs (cienegas) are recognized as important livestock supply, wildlife habitat, and recreational resources. The availability of water in the Rio Grande and Pecos River (Run-of-River) to meet existing water rights, including municipal water rights, is determined by the TCEQ Rio Grande Water Availability Model (WAM)–Run 3, except for supplies from the Rio Grande Project. All surface water rights are listed in Appendix 3A.
- The availability of groundwater is based on TWDB provided Modeled Available Groundwater (MAG) as developed through the Groundwater Management Area process. For aquifers that MAG volumes have not been assigned, groundwater availability is calculated separately.
- Direct reuse refers to wastewater that is reused without first being discharged into a stream or other watercourse. Direct reuse of water is calculated for El Paso Water based on anticipated build-out of their "purple pipe" project and advanced purified water treatment projects. Indirect reuse refers to wastewater that is first discharged to a stream or watercourse before being diverted for use. The indirect reuse supply is used during the irrigation season.
- No groundwater availability requirements or limitations as might have been promulgated by the El Paso County Commissioner's Court are associated with the El Paso County Priority Groundwater Management Area. El Paso Water continues to assume the role as the designated "Regional Water Supply Planner".
- Water supplies based upon contracts are assumed to be renewed if they expire during the planning horizon.

The Rio Grande originates in southwestern Colorado and northern New Mexico, where it derives its headwaters from snowmelt in the Rocky Mountains. The Elephant Butte Dam and Reservoir in New Mexico is approximately 125 miles north of El Paso and can store over two million acre-feet of water. Water in the reservoir is stored to meet irrigation demands in the Rincon, Mesilla, El Paso, and Juarez Valleys and is released in a pattern for power generation. Above El Paso, flow in the River is largely controlled by releases from Caballo Reservoir located below Elephant Butte; while downstream from El Paso to Fort Quitman, flow consists of treated municipal wastewater from El Paso, untreated municipal wastewater from Juarez, and irrigation return flow. Below the El Paso-Hudspeth County line, flow consists mostly of return flow and occasional floodwater and runoff from adjacent areas. Channel losses are significant enough that the Rio Grande is often dry from below Fort Quitman to the confluence with the Mexican river, the Rio Conchos, upstream of Presidio. There are no significant perennial tributaries, other than the Rio Conchos, in the 350 miles between Elephant Butte Reservoir and Presidio.

The Rio Grande is unique in its complexity of distribution management. Because the waters of the River must be shared between three U.S. states and Mexico, a system of federal, state and local programs has been developed to oversee the equitable distribution of water. Compacts, treaties and projects currently provide the River's management framework.

The Pecos River is the largest Texas river basin that flows into the Rio Grande. Originating in New Mexico, the Pecos flows southerly into Texas, and discharges into the channel of the Rio Grande near Langtry in Val Verde County. The River forms the easternmost border of Far West Texas along the northeast corner of Terrell County. Flows of the Pecos River are controlled by releases from the Red Bluff Reservoir near the Texas - New Mexico state line. Storage in the reservoir is affected by the delivery of water from New Mexico. According to data of the IBWC, the Pecos River contributes an average of 11 percent of the annual streamflow into the Rio Grande near Amistad Reservoir. The Pecos also contributes more than 29 percent of the annual salt loading into the reservoir.

Other than irrigation use and a portion of City of El Paso municipal use from the Rio Grande, almost all other water use in Far West Texas is supplied from groundwater sources. Although not as large in areal extent as some aquifers in the State, individual aquifers in Far West Texas are more numerous (10 TWDB designated and 3 Planning Group designated) than in any of the other planning regions.

El Paso has nearly 50 miles of reclaimed water lines (purple pipeline) in place in all areas of the City. Reclaimed water serves the landscape irrigation demand of golf courses, parks, schools, and cemeteries, and provides water supplies for steam electric plants and industries within the City. Currently EPW is operating three reuse projects that provide 6,000 acre-feet per year. This *Plan* explores the potential of a significant increase in reuse of existing supplies by evaluating strategies of advanced treatment to produce purified water that meets state drinking water standards.

Springs and seeps are found in all seven of the Far West Texas counties and have played an important role in the development of the Region. Springs were important sources of water for Native Americans, as indicated by the artifacts and petroglyphs found near many of the springs. In the 18th and 19th centuries, locations of transportation routes including supply and stagecoach lines, military outposts, railroads, and early settlements and ranches were largely determined by the occurrence of springs that issued from locations in the mountains and along mountain fronts.

Springs contribute to the aesthetic and recreational value of private land and parkland in Far West Texas - especially in the Big Bend area, where many thermal springs discharge along the banks of the Rio Grande. Springs are significant sources of water for both aquatic and terrestrial wildlife as they form small wetlands that attract migratory birds and other fowl that inhabit the Region throughout the year. The FWTWPG recognizes the importance of all springs in this desert community for their contribution as a water supply source and as a natural habitat. However, the FWTWPG chooses to respect the privacy of private lands and therefore specifically identifies "Major Springs" occurring only on state, federal, or privately owned conservation managed lands.

WATER MANAGEMENT STRATEGIES

Projected water supply deficits in Far West Texas during the next 50 years are identified where anticipated water demands exceed available supplies. Available supplies represent the largest amount of water that can be diverted or pumped from a given source without violating the most restrictive physical, regulatory, or policy condition limiting use, under drought-of-record conditions. Water supply deficits are identified for specified municipal utilities, irrigation use, mining use, and steam power electric generation in El Paso County; and in the Rural counties, for irrigation use in Culberson County, and for mining use in Hudspeth and Terrell Counties.

Water supply strategy recommendations intended to meet the deficits are made for those water use groups that have projected water supply shortages. In addition, strategies have been developed for entities that have expressed a desire for planned projects for which funding applications have been or will be made in the future to be included in the *Plan*. In the development of water management strategies, existing water rights, water contracts, and option agreements are recognized and fully protected.

A strategy evaluation procedure was designed to provide a side-by-side comparison such that all the strategies could be assessed based on the same factors. Specific factors considered were:

- Quantity of water supply generated
- Water quality considerations
- Reliability
- Cost (total capital cost, annual cost, and cost per acre-foot)
- Environmental impacts
- Impacts to agricultural and natural resources

To adequately consider the unique challenges faced by municipal and industrial water users in El Paso County, a conjunctive approach was used to establish feasible strategies capable of identifying sufficient future supplies to meet the water needs of El Paso Water, the largest wholesale water provider in the county. The following recommended projects are to be managed conjunctively to produce a mixed total distributed supply:

- Municipal conservation programs
- Advanced water purification at the Bustamante WWTP
- Expansion of current Hueco Bolson Aquifer ASR
- Groundwater development in the Dell City area (Phase I and II)
- Additional alternate projects including advanced water purification, expansion of existing groundwater use, treatment and reuse of other local supplies, and expansion of existing desalination facilities

Recommended strategies for other entities in El Paso County include purchasing needed supplies from El Paso Water or developing needed self-supplied groundwater by drilling additional wells and expanding desalination facilities.

Irrigation shortages in El Paso County is the direct result of insufficient water in the Rio Grande during drought-of-record periods to meet anticipated needs. The quantity of water needed to meet the full demands cannot be realistically achieved and farmers in these areas have generally approached this situation by reducing irrigated acreage, changing types of crops planted, or possibly not planting crops until water becomes available during the following season.

In some cases, farmers may benefit from Best Management Practices (BMPs) for agricultural water users, which are a mixture of site-specific management, educational, and physical procedures that have proven to be effective and are cost-effective for conserving water. However, a local study of these practices found that very limited opportunities exist for significant additional water conservation in Far West Texas irrigated agriculture. Those practices that suggest economic efficient additional water conservation included lining or pipelining district canals and the very small potential for additional irrigation scheduling and tail water recovery systems. In nearly all cases, these practices have been adapted if applicable, further emphasizing the very limited opportunities for additional conservation. If these strategies were implemented, the water conserved would satisfy less than the projected unmet agricultural water demand in 2070 during drought-of-record conditions. Based on this evaluation, the FWTWPG recommends tail-water reuse, improvements to water district delivery systems, construction of a regulating reservoir, and the development of a new diversion point at the La Union canal to attempt to meet the estimated irrigation needs in El Paso County.

Although most of the communities in the rural counties do not project shortages, it is apparent that many the communities have water issues that are appropriate for listing in this *Regional Plan*. Therefore, strategies have been evaluated and presented that will hopefully provide incentive for the future development of water resources to address these issues. The *2021 Far West Texas Water Plan* contains a total of 48 recommended water management strategies and 10 alternative strategy with a total estimated capital cost for develop of $2,110,409,105.

WATER QUALITY

Water quality plays an important role in determining the availability of water supplies to meet current and future water needs in the Region. The quality of groundwater and surface water is evaluated to help determine the suitability of each source for use and the potential impacts on these sources that might result from the implementation of recommended water management strategies.

Groundwater quality issues in the Region are generally related to naturally high concentrations of total dissolved solids (TDS) or to the occurrence of elevated concentrations of individual dissolved constituents. High concentrations of TDS are primarily the result of the lack of sufficient recharge and restricted circulation. Together, these retard the flushing action of fresh water moving through the aquifers. Some aquifers, however, have a low TDS but may contain individual constituent levels that exceed safe drinking-water standards. For example, some wells in the Igneous Aquifer have exceptionally low TDS but contain unsatisfactory levels of fluoride.

Groundwater quality changes are often the result of man's activities. In agricultural areas, aquifers such as the Bone Spring-Victorio Peak have increased in TDS. Irrigation water applied on the fields percolates back to the aquifer carrying salts leached from the soil. Beneath El Paso and Ciudad Juarez, the average concentration of dissolved solids in the Hueco Bolson Aquifer has increased as the fresher water in the aquifer is being consumed. Although local instances of groundwater quality degradation have occurred in the Region, there are no major trends that suggest a widespread water-quality problem due to the downward percolation of surface contaminants.

The Rio Grande and the Pecos River are the principal surface water sources in Far West Texas. Unlike groundwater, surface water quality can vary significantly depending on the amount of flow in the streambed and the rate and source of runoff from adjacent lands. Salinity is an issue associated with the Rio Grande, especially during drought conditions. River flows arriving at El Paso contain a substantial salinity contribution from irrigation return flow and municipal wastewater return in New Mexico. Under current conditions, approximately 25 percent of the applied irrigation water is needed to move through the project in El Paso County to keep the salt loading at reasonable and manageable levels given average surface flow rates. Studies have shown that salinities in the Rio Grande can increase to over 1,000 mg/l during May and September, depending on actual irrigation demands and releases from reservoirs.

Downstream from El Paso, most of the flow consists of irrigation return flow, and small amounts of treated and untreated municipal wastewater. Heavy metals and pesticides have been identified along this segment of the Rio Grande. Flow is intermittent downstream to Presidio, where the Rio Conchos augments flow. Fresh water springs contribute to the Rio Grande flow in the Big Bend and enhance the overall quality of the River through this reach.

The Pecos River is not a source of drinking water for communities in Far West Texas; however, it is the most prominent tributary to the Rio Grande on the Texas side of the River above Amistad Reservoir. According to IBWC data, the Pecos River contributes an average of 11 percent of the annual stream flow in the Rio Grande above the Reservoir and 29 percent of the annual salt load. Independence Creek's contribution in Terrell County increases the Pecos River water volume by 42 percent at the confluence and significantly reduces the total suspended solids, thus improving both water quantity and quality.

WATER CONSERVATION AND DROUGHT CONTINGENCY

Water conservation are those practices, techniques, programs, and technologies that will protect water resources, reduce the consumption of water, reduce the loss or waste of water, or improve the efficiency in the use of water. Recycling or reuse of water is also a creative method of managing water so that it can be used more than once or for alternative uses. Water conservation and drought contingency planning implemented by municipalities, water providers, and other water users supersede recommendations in this *Plan* and are considered consistent with this *Plan*. Texas Water Code §11.1271 requires water conservation plans for all municipal and industrial water users with surface water rights of 1,000 acre-feet per year or more and irrigation water users with surface water rights of 10,000 acre-feet per year or more.

El Paso Water is the largest supplier of municipal water in Far West Texas and has been implementing an aggressive water conservation program, which has reduced the per capita demand from about 225 gpcd in the late 1970s to a current level of 128 gpcd. The continuation of the conservation effort is a key component of the El Paso Water Integrated Water Management Strategy.

Drought is a frequent and inevitable factor in the climate of Texas. Therefore, it is vital to plan for the effect that droughts will have on the use, allocation and conservation of water in the State. Far West Texas is perennially under drought or near-drought conditions compared with more humid areas of the State. Although residents of the Region are generally accustomed to these conditions, the low rainfall and the accompanying high levels of evaporation underscore the necessity of developing plans that respond to potential disruptions in the supply of groundwater and surface water caused by drought conditions. In the consideration of regional conservation and drought management issues, the FWTWPG reviewed active water conservation and drought management plans provided to the planning group by public water suppliers and irrigation districts.

The Texas Legislature has established a process for local management of groundwater resources through groundwater conservation districts. The districts are charged with managing groundwater by providing for the conservation, preservation, protection, recharging and prevention of waste of groundwater within their jurisdictions. Six districts are currently in operation within Far West Texas.

- Brewster County Groundwater Conservation District
- Culberson County Groundwater Conservation District
- Hudspeth County Underground Water Conservation District No.1
- Jeff Davis County Underground Water Conservation District
- Presidio County Underground Water Conservation District
- Terrell County Groundwater Conservation District

PROTECTION OF WATER, AGRICULTURAL, AND NATURAL RESOURCES

The long-term protection of the Region's water, agricultural, and natural resources, and the environment is an important component of this *2021 Far West Texas Water Plan*. The first step in achieving long-term water resources protection was in the process of estimating each source's availability. Surface water estimates were developed through a water availability model process (WAM) and are based on the quantity of surface water available to meet existing water rights during a drought-of-record. The availability of groundwater is based on TWDB provided Modeled Available Groundwater (MAG) as developed through the Groundwater Management Area process. For aquifers that MAG volumes have not been assigned, groundwater availability is based on previous geohydrologic studies, groundwater data including historical use contained in state and federal databases and groundwater availability models (GAMs). Also included are groundwater supplies that are made available by the desalination of brackish groundwater sources. Establishing conservative levels of water source availability thus results in less potential of overexploiting the supply.

The next step in establishing the long-term protection of water resources occurs in the water management strategies to meet potential water supply shortages. Each strategy was evaluated for potential threats to water resources in terms of source depletion (reliability), quality degradation, and impact to environmental habitat. Water conservation strategies are also recommended for each entity with a supply deficit. When enacted, the conservation practices will diminish water demand and thus extend supplies over the stress period.

Agriculture includes the raising of crops and livestock, as well as a multitude of businesses that support this industry. Water is an absolute necessity to maintaining this industry and its use represents over three-fourths of all the water used in the Region. It is thus important to the economic health and way of life in the Region to protect water resources that have historically been used in the support of agricultural activities. The *2021 Far West Texas Water Plan* provides irrigation strategy recommendations that address water conservation management practices. If implemented, these practices will result in reduced water application per acre irrigated and diminished water losses due to canal leakage. All non-agricultural recommended water management strategies include an analysis of potential impact to agricultural interests. Any strategy that necessitates the conversion of water use from agricultural practices is voluntary at the current water right and landowner's discretion.

The FWTWPG has adopted a stance toward the protection of natural resources. The protection is closely linked with the protection of water resources as discussed above. Where possible, the methodology used to assess groundwater source availability is based on not significantly lowering water levels to a point where spring flows might be impacted. Thus, the intention to protect surface flows is directly related to those natural resources that are dependent on surface water sources or spring flows for their existence.

Environmental impacts were evaluated in the consideration of strategies to meet water-supply deficits. Of prime consideration was whether a strategy potentially could diminish the quantity of water currently existing in the natural environment and if a strategy could impact water quality to a level that would be detrimental to animals and plants that naturally inhabit the area under consideration. The FWTWPG has also recommended several "Ecologically Unique River and Stream Segments".

RECOMMENDATIONS

An important aspect of the regional water planning process is the opportunity to provide recommendations for the improvement of future water management planning in Texas. The recommendations are designed to present new and/or modified approaches to key technical, administrative, institutional, and policy matters that will help to streamline the planning process, and to offer guidance to future planners regarding specific issues of concern within the Region. The FWTWPG approves of the legislative intent of the regional water planning process and supports the continuance of water planning at the regional level. In further support of the planning process, the FWTWPG suggests that the Legislature and TWDB consider the following issues pertaining to water management policy, regional water planning process, and water research needs.

- Stormwater / flood planning that encourages retaining stormwater as a water supply source
- Support of funding for Colonias projects
- Encouragement of State legal rectification to protect Rio Grande Compact
- Re-emphasis of the planning function of the regional water planning group and need for more local planning initiatives
- Allowance of modification of demand numbers
- Dissatisfaction with inter-period modification of contractual planning guidelines
- Dissatisfaction with unfunded Task 5A planning requirement
- Suggestion of several specified water research and data needs that would support the local planning process

As a part of the planning process, each regional planning group may include recommendations for the designation of ecologically unique river and stream segments in their adopted regional water plan. The Texas Legislature may designate a river or stream segment of unique ecological value following the recommendations of a regional water planning group. As per §16.051(f) of the Texas Water Code, this designation solely means that a state agency or political subdivision of the State may not finance the actual construction of a reservoir in a specific river or stream segment designated by the legislature under this subsection. The Far West Texas Water Planning Group intends that no negative impact is to occur to upstream landowners as a result of these designations.

The FWTWPG chooses to respect the privacy of private lands and therefore recommends as "Ecologically Unique River and Stream Segments" the following three streams that lie within the boundaries of state-managed properties, four within National Park boundaries, and specified streams managed by the Texas Nature Conservancy and the Trans Pecos Water Trust.

- Rio Grande Wild and Scenic River (Big Bend National Park)
- McKittrick Canyon and Choza Creek (Guadalupe Mountains National Park)
- Cienega Creek (Chinati Mountains State Natural Area)
- Alamito and Cienega Creeks (Big Bend Ranch State Park)
- Alamito Creek (Trans Pecos Water Trust)

- Independence Creek (Texas Nature Conservancy - Independence Creek Preserve)
- Madera Creek, Canyon Headwaters of Limpia Creek, Little Aguja Creek, and Upper Cherry Creek (Texas Nature Conservancy - Davis Mountains Preserve)
- Terlingua Creek (Big Bend National Park)

The firm yield for any reservoirs constructed on even the most reliable Far West Texas watercourses is not likely to exceed 2,000 acre-feet per year. For this reason, the *2021 Far West Texas Water Plan* does not recommend any watercourse for designation as "Unique Sites for Reservoir Construction."

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ES – APPENDIX

TWDB WATER PLANNING DATA REPORTS

- **Water User Group (WUG) Population**
- **WUG Demand**
- **WUG Category Summary**
- **Source Availability**
- **WUG Existing Water Supply**
- **WUG Needs / Surplus**
- **WUG Second-Tier Identified Water Needs**
- **WUG Second-Tier Water Needs Summary**
- **Source Water Balance (Availability – WUG Supply)**
- **WUG Data Comparison to 2016 Regional Water Plan**
- **Source Data Comparison to 2016 Regional Water Plan**
- **WUG Unmet Needs**
- **WUG Unmet Needs Summary**
- **Recommended WUG Water Management Strategies**
- **Recommended Projects Associated with Water Management Strategies**
- **Alternate WUG Water Management Strategies**
- **Alternate Projects Associated with Water Management Strategies**
- **WUG Management Supply Factor**
- **Recommended Water Management Strategy Supply Associated with a New or Amended Inter-Basin Transfer Permit** ***(No relevant data for the FWT Region)***
- **WUG Recommended WUG Supply Associated with a New or Amended Inter-Basin Transfer Permit and Total Recommended Conservation Water Management Supply** ***(No relevant data for the FWT Region)***
- **Recommended Water Management Strategy Supplies Unallocated to WUG** ***(No relevant data for the FWT Region)***
- **WUG Strategy Supplies by Water Management Strategy Type**
- **WUG Recommended Water Management Strategy Supplies by Source Type**
- **Major Water Provider Existing Sales and Transfers**
- **Major Water Provider Water Management Strategy Summary**

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Region E Water User Group (WUG) Population

	WUG POPULATION					
	2020	2030	2040	2050	2060	2070
ALPINE	6,066	6,185	6,231	6,265	6,283	6,293
LAJITAS MUNICIPAL SERVICES	542	561	568	575	579	579
MARATHON WATER SUPPLY & SEWER SERVICE	444	460	466	471	474	475
COUNTY-OTHER	2,675	2,885	2,965	3,023	3,051	3,070
RIO GRANDE BASIN TOTAL	**9,727**	**10,091**	**10,230**	**10,334**	**10,387**	**10,417**
BREWSTER COUNTY TOTAL	**9,727**	**10,091**	**10,230**	**10,334**	**10,387**	**10,417**
VAN HORN	2,319	2,542	2,641	2,730	2,782	2,815
COUNTY-OTHER	376	412	428	443	451	457
RIO GRANDE BASIN TOTAL	**2,695**	**2,954**	**3,069**	**3,173**	**3,233**	**3,272**
CULBERSON COUNTY TOTAL	**2,695**	**2,954**	**3,069**	**3,173**	**3,233**	**3,272**
ANTHONY	4,206	5,053	5,840	6,620	7,358	8,052
EAST BIGGS WATER SYSTEM	11,870	11,870	11,870	11,870	11,870	11,870
EAST MONTANA WATER SYSTEM	6,599	7,529	8,391	9,247	10,057	10,818
EL PASO COUNTY TORNILLO WID	3,202	3,215	3,229	3,242	3,254	3,266
EL PASO COUNTY WCID 4	8,858	9,131	9,385	9,636	9,874	10,098
EL PASO WATER	734,031	822,625	904,900	986,455	1,063,672	1,136,275
FEDERAL CORRECTIONAL INSTITUTION LA TUNA	1,668	1,668	1,668	1,668	1,668	1,668
FORT BLISS WATER SERVICES	26,453	27,499	28,471	29,434	30,343	31,200
HACIENDAS DEL NORTE WID	1,218	1,389	1,548	1,706	1,855	1,996
HORIZON REGIONAL MUD	52,993	74,830	95,108	115,207	134,239	152,133
LOWER VALLEY WATER DISTRICT	53,059	63,682	73,546	83,325	92,582	101,287
PASEO DEL ESTE MUD 1	8,116	9,260	10,320	11,372	12,369	13,304
COUNTY-OTHER | VINTON HILLS ESTATES	370	505	631	756	874	985
COUNTY-OTHER | VINTON HILLS SUBDIVISION	861	1,176	1,469	1,759	2,034	2,292
COUNTY-OTHER	12,061	16,471	20,569	24,630	28,478	32,096
RIO GRANDE BASIN TOTAL	**925,565**	**1,055,903**	**1,176,945**	**1,296,927**	**1,410,527**	**1,517,340**
EL PASO COUNTY TOTAL	**925,565**	**1,055,903**	**1,176,945**	**1,296,927**	**1,410,527**	**1,517,340**
ESPERANZA WATER SERVICE	905	996	1,023	1,043	1,053	1,058
HUDSPETH COUNTY WCID 1	952	1,044	1,073	1,095	1,105	1,112
COUNTY-OTHER | DELL CITY	424	467	480	489	494	496
COUNTY-OTHER | FORT HANCOCK WCID	1,079	1,188	1,222	1,246	1,258	1,263
COUNTY-OTHER	553	609	626	638	643	646
RIO GRANDE BASIN TOTAL	**3,913**	**4,304**	**4,424**	**4,511**	**4,553**	**4,575**
HUDSPETH COUNTY TOTAL	**3,913**	**4,304**	**4,424**	**4,511**	**4,553**	**4,575**
FORT DAVIS WSC	1,361	1,361	1,361	1,361	1,361	1,361
COUNTY-OTHER | CITY OF VALENTINE	198	198	198	198	198	198
COUNTY-OTHER	839	839	839	839	839	839
RIO GRANDE BASIN TOTAL	**2,398**	**2,398**	**2,398**	**2,398**	**2,398**	**2,398**
JEFF DAVIS COUNTY TOTAL	**2,398**	**2,398**	**2,398**	**2,398**	**2,398**	**2,398**
MARFA	2,583	2,807	3,022	3,261	3,473	3,674
PRESIDIO	5,458	5,884	6,297	6,749	7,153	7,538
COUNTY-OTHER	651	754	855	962	1,062	1,155
RIO GRANDE BASIN TOTAL	**8,692**	**9,445**	**10,174**	**10,972**	**11,688**	**12,367**
PRESIDIO COUNTY TOTAL	**8,692**	**9,445**	**10,174**	**10,972**	**11,688**	**12,367**
TERRELL COUNTY WCID 1	870	890	890	890	890	890
COUNTY-OTHER	175	179	179	179	179	179

*A single asterisk next to a WUG's name denotes that the WUG is split by two or more planning regions.

Region E Water User Group (WUG) Population

	WUG POPULATION					
	2020	2030	2040	2050	2060	2070
RIO GRANDE BASIN TOTAL	1,045	1,069	1,069	1,069	1,069	1,069
TERRELL COUNTY TOTAL	1,045	1,069	1,069	1,069	1,069	1,069
REGION E POPULATION TOTAL	954,035	1,086,164	1,208,309	1,329,384	1,443,855	1,551,438

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Region E Water User Group (WUG) Demand

	WUG DEMAND (ACRE-FEET PER YEAR)					
	2020	**2030**	**2040**	**2050**	**2060**	**2070**
ALPINE	1,934	1,944	1,935	1,933	1,937	1,940
LAJITAS MUNICIPAL SERVICES	103	104	103	103	104	104
MARATHON WATER SUPPLY & SEWER SERVICE	124	126	126	127	127	127
COUNTY-OTHER	411	431	433	436	439	442
LIVESTOCK	347	347	347	347	347	347
IRRIGATION	2,006	2,006	2,006	2,006	2,006	2,006
RIO GRANDE BASIN TOTAL	**4,925**	**4,958**	**4,950**	**4,952**	**4,960**	**4,966**
BREWSTER COUNTY TOTAL	**4,925**	**4,958**	**4,950**	**4,952**	**4,960**	**4,966**
VAN HORN	662	711	737	760	774	783
COUNTY-OTHER	65	69	71	73	74	75
MANUFACTURING	5	6	6	6	6	6
MINING	2,119	2,853	3,006	2,723	2,456	2,253
LIVESTOCK	270	270	270	270	270	270
IRRIGATION	37,863	37,863	37,863	37,863	37,863	37,863
RIO GRANDE BASIN TOTAL	**40,984**	**41,772**	**41,953**	**41,695**	**41,443**	**41,250**
CULBERSON COUNTY TOTAL	**40,984**	**41,772**	**41,953**	**41,695**	**41,443**	**41,250**
ANTHONY	770	905	1,033	1,163	1,291	1,412
EAST BIGGS WATER SYSTEM	798	798	798	798	798	798
EAST MONTANA WATER SYSTEM	806	891	974	1,064	1,155	1,241
EL PASO COUNTY TORNILLO WID	320	312	306	303	303	304
EL PASO COUNTY WCID 4	810	793	781	783	798	816
EL PASO WATER	110,572	120,315	129,713	139,978	150,601	160,792
FEDERAL CORRECTIONAL INSTITUTION LA TUNA	352	345	342	340	339	339
FORT BLISS WATER SERVICES	4,881	4,921	5,024	5,182	5,331	5,481
HACIENDAS DEL NORTE WID	196	218	240	262	285	306
HORIZON REGIONAL MUD	7,936	11,043	13,962	16,868	19,630	22,235
LOWER VALLEY WATER DISTRICT	5,714	6,563	7,398	8,290	9,189	10,045
PASEO DEL ESTE MUD 1	1,054	1,167	1,278	1,397	1,515	1,629
COUNTY-OTHER | VINTON HILLS ESTATES	64	85	104	124	144	162
COUNTY-OTHER | VINTON HILLS SUBDIVISION	149	197	242	290	334	376
COUNTY-OTHER	2,086	2,758	3,395	4,055	4,680	5,272
MANUFACTURING	7,028	8,157	8,157	8,157	8,157	8,157
MINING	4,008	4,626	5,262	5,948	6,693	7,539
STEAM ELECTRIC POWER	10,545	10,545	10,545	10,545	10,545	10,545
LIVESTOCK	171	171	171	171	171	171
IRRIGATION	149,570	149,570	149,570	149,570	149,570	149,570
RIO GRANDE BASIN TOTAL	**307,830**	**324,380**	**339,295**	**355,288**	**371,529**	**387,190**
EL PASO COUNTY TOTAL	**307,830**	**324,380**	**339,295**	**355,288**	**371,529**	**387,190**
ESPERANZA WATER SERVICE	142	152	153	154	155	156
HUDSPETH COUNTY WCID 1	142	151	152	153	154	155
COUNTY-OTHER | DELL CITY	45	47	47	47	47	47
COUNTY-OTHER | FORT HANCOCK WCID	114	119	119	119	120	121
COUNTY-OTHER	58	61	61	61	61	62
MINING	479	451	468	483	492	502
LIVESTOCK	437	437	437	437	437	437
IRRIGATION	115,542	115,542	115,542	115,542	115,542	115,542

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Region E Water User Group (WUG) Demand

	WUG DEMAND (ACRE-FEET PER YEAR)					
	2020	**2030**	**2040**	**2050**	**2060**	**2070**
RIO GRANDE BASIN TOTAL	**116,959**	**116,960**	**116,979**	**116,996**	**117,008**	**117,022**
HUDSPETH COUNTY TOTAL	**116,959**	**116,960**	**116,979**	**116,996**	**117,008**	**117,022**
FORT DAVIS WSC	319	314	309	307	307	307
COUNTY-OTHER | CITY OF VALENTINE	29	28	28	27	27	27
COUNTY-OTHER	124	120	117	115	115	115
MINING	153	153	153	153	153	153
LIVESTOCK	397	397	397	397	397	397
IRRIGATION	665	665	665	665	665	665
RIO GRANDE BASIN TOTAL	**1,687**	**1,677**	**1,669**	**1,664**	**1,664**	**1,664**
JEFF DAVIS COUNTY TOTAL	**1,687**	**1,677**	**1,669**	**1,664**	**1,664**	**1,664**
MARFA	690	735	781	841	895	947
PRESIDIO	738	772	808	856	905	953
COUNTY-OTHER	100	112	123	139	153	166
MINING	403	0	0	0	0	0
LIVESTOCK	328	328	328	328	328	328
IRRIGATION	4,006	4,006	4,006	4,006	4,006	4,006
RIO GRANDE BASIN TOTAL	**6,265**	**5,953**	**6,046**	**6,170**	**6,287**	**6,400**
PRESIDIO COUNTY TOTAL	**6,265**	**5,953**	**6,046**	**6,170**	**6,287**	**6,400**
TERRELL COUNTY WCID 1	178	178	178	177	177	177
COUNTY-OTHER	21	21	20	20	20	20
MINING	673	776	740	606	483	385
LIVESTOCK	151	151	151	151	151	151
IRRIGATION	751	751	751	751	751	751
RIO GRANDE BASIN TOTAL	**1,774**	**1,877**	**1,840**	**1,705**	**1,582**	**1,484**
TERRELL COUNTY TOTAL	**1,774**	**1,877**	**1,840**	**1,705**	**1,582**	**1,484**
REGION E DEMAND TOTAL	**480,424**	**497,577**	**512,732**	**528,470**	**544,473**	**559,976**

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Region E Water User Group (WUG) Category Summary

MUNICIPAL	2020	2030	2040	2050	2060	2070
POPULATION	933,773	1,060,481	1,177,848	1,294,222	1,404,294	1,507,762
DEMAND (acre-feet per year)	139,241	153,458	167,131	181,839	196,770	211,047
EXISTING SUPPLIES (acre-feet per year)	170,337	170,337	170,337	170,337	170,337	170,337
NEEDS (acre-feet per year)*	4,067	8,023	11,777	24,553	38,837	52,489

COUNTY-OTHER	2020	2030	2040	2050	2060	2070
POPULATION	20,262	25,683	30,461	35,162	39,561	43,676
DEMAND (acre-feet per year)	3,266	4,048	4,760	5,506	6,214	6,885
EXISTING SUPPLIES (acre-feet per year)	8,778	8,778	8,778	8,778	8,778	8,778
NEEDS (acre-feet per year)*	35	38	38	52	116	177

MANUFACTURING	2020	2030	2040	2050	2060	2070
DEMAND (acre-feet per year)	7,033	8,163	8,163	8,163	8,163	8,163
EXISTING SUPPLIES (acre-feet per year)	7,303	7,303	7,303	7,303	7,303	7,303
NEEDS (acre-feet per year)*	0	860	860	860	860	860

MINING	2020	2030	2040	2050	2060	2070
DEMAND (acre-feet per year)	7,835	8,859	9,629	9,913	10,277	10,832
EXISTING SUPPLIES (acre-feet per year)	7,231	7,231	7,231	7,231	7,231	7,231
NEEDS (acre-feet per year)*	2,530	3,223	3,840	4,407	5,038	5,796

STEAM ELECTRIC POWER	2020	2030	2040	2050	2060	2070
DEMAND (acre-feet per year)	10,545	10,545	10,545	10,545	10,545	10,545
EXISTING SUPPLIES (acre-feet per year)	3,285	3,285	3,285	3,285	3,285	3,285
NEEDS (acre-feet per year)*	7,260	7,260	7,260	7,260	7,260	7,260

LIVESTOCK	2020	2030	2040	2050	2060	2070
DEMAND (acre-feet per year)	2,101	2,101	2,101	2,101	2,101	2,101
EXISTING SUPPLIES (acre-feet per year)	2,391	2,391	2,391	2,391	2,391	2,391
NEEDS (acre-feet per year)*	0	0	0	0	0	0

IRRIGATION	2020	2030	2040	2050	2060	2070
DEMAND (acre-feet per year)	310,403	310,403	310,403	310,403	310,403	310,403
EXISTING SUPPLIES (acre-feet per year)	281,318	281,318	275,793	275,793	275,793	275,793
NEEDS (acre-feet per year)*	46,737	46,737	52,262	52,262	52,262	52,262

*WUG supplies and projected demands are entered for each of a WUG's region-county-basin divisions. The needs shown in the WUG Category Summary report are calculated by first deducting the WUG split's projected demand from its total existing water supply volume. If the WUG split has a greater existing supply volume than projected demand in any given decade, this amount is considered a surplus volume. Before aggregating the difference between supplies and demands to the WUG category level, calculated surpluses are updated to zero so that only the WUGs with needs in the decade are included with the Needs totals.

Region E Source Availability

GROUNDWATER SOURCE TYPE				SOURCE AVAILABILITY (ACRE-FEET PER YEAR)					
SOURCE NAME	**COUNTY**	**BASIN**	**SALINITY ***	**2020**	**2030**	**2040**	**2050**	**2060**	**2070**
BONE SPRING-VICTORIO PEAK AQUIFER	HUDSPETH	RIO GRANDE	FRESH/ BRACKISH	101,400	101,400	101,400	101,400	101,400	101,400
CAPITAN REEF COMPLEX AQUIFER	BREWSTER	RIO GRANDE	FRESH/ BRACKISH	583	583	583	583	583	583
CAPITAN REEF COMPLEX AQUIFER	CULBERSON	RIO GRANDE	FRESH/ BRACKISH	7,580	7,580	7,580	7,580	7,580	7,580
CAPITAN REEF COMPLEX AQUIFER	HUDSPETH	RIO GRANDE	FRESH/ BRACKISH	8,695	8,695	8,695	8,695	8,695	8,695
CAPITAN REEF COMPLEX AQUIFER	JEFF DAVIS	RIO GRANDE	FRESH	0	0	0	0	0	0
EDWARDS-TRINITY-PLATEAU AND PECOS VALLEY AQUIFERS	JEFF DAVIS	RIO GRANDE	FRESH	374	374	374	374	374	374
EDWARDS-TRINITY-PLATEAU AQUIFER	BREWSTER	RIO GRANDE	FRESH/ BRACKISH	1,394	1,394	1,394	1,394	1,394	1,394
EDWARDS-TRINITY-PLATEAU AQUIFER	CULBERSON	RIO GRANDE	FRESH	399	399	399	399	399	399
EDWARDS-TRINITY-PLATEAU, PECOS VALLEY, AND TRINITY AQUIFERS	TERRELL	RIO GRANDE	FRESH	1,420	1,420	1,420	1,420	1,420	1,420
HUECO-MESILLA BOLSON AQUIFER	EL PASO	RIO GRANDE	FRESH/ BRACKISH	435,000	435,000	435,000	435,000	435,000	435,000
HUECO-MESILLA BOLSON AQUIFER	HUDSPETH	RIO GRANDE	FRESH/ BRACKISH	45,000	45,000	45,000	45,000	45,000	45,000
IGNEOUS AQUIFER	BREWSTER	RIO GRANDE	FRESH	2,586	2,586	2,585	2,583	2,583	2,582
IGNEOUS AQUIFER	CULBERSON	RIO GRANDE	FRESH	99	99	99	99	99	99
IGNEOUS AQUIFER	JEFF DAVIS	RIO GRANDE	FRESH	4,584	4,584	4,584	4,584	4,584	4,584
IGNEOUS AQUIFER	PRESIDIO	RIO GRANDE	FRESH	4,064	4,064	4,064	4,063	4,063	4,063
MARATHON AQUIFER	BREWSTER	RIO GRANDE	FRESH	7,327	7,327	7,327	7,327	7,327	7,327
OTHER AQUIFER	BREWSTER	RIO GRANDE	FRESH	1,896	1,896	1,896	1,896	1,896	1,896
OTHER AQUIFER	EL PASO	RIO GRANDE	BRACKISH	57,922	57,922	57,922	57,922	57,922	57,922
OTHER AQUIFER	HUDSPETH	RIO GRANDE	BRACKISH	52,478	52,478	52,478	52,478	52,478	52,478
OTHER AQUIFER	HUDSPETH	RIO GRANDE	FRESH	26,400	26,400	26,400	26,400	26,400	26,400
RUSTLER AQUIFER	BREWSTER	RIO GRANDE	BRACKISH/SALI NE	0	0	0	0	0	0
RUSTLER AQUIFER	CULBERSON	RIO GRANDE	BRACKISH/SALI NE	53	53	53	53	53	53
RUSTLER AQUIFER	JEFF DAVIS	RIO GRANDE	FRESH	0	0	0	0	0	0
WEST TEXAS BOLSONS AQUIFER	CULBERSON	RIO GRANDE	BRACKISH	16,851	16,851	16,851	16,851	16,851	16,851
WEST TEXAS BOLSONS AQUIFER	CULBERSON	RIO GRANDE	FRESH/ BRACKISH	35,749	35,678	35,601	35,550	35,476	35,409
WEST TEXAS BOLSONS AQUIFER	HUDSPETH	RIO GRANDE	BRACKISH	429	429	429	429	429	429
WEST TEXAS BOLSONS AQUIFER	HUDSPETH	RIO GRANDE	FRESH/ BRACKISH	4,582	4,582	4,582	4,582	4,582	4,582
WEST TEXAS BOLSONS AQUIFER	JEFF DAVIS	RIO GRANDE	FRESH/ BRACKISH	6,137	6,137	6,071	6,042	6,009	5,974
WEST TEXAS BOLSONS AQUIFER	PRESIDIO	RIO GRANDE	FRESH	9,112	8,982	8,834	8,710	8,571	8,436
WEST TEXAS BOLSONS AQUIFER	PRESIDIO	RIO GRANDE	FRESH/ BRACKISH	7,743	7,743	7,743	7,743	7,743	7,743
			GROUNDWATER SOURCE AVAILABILITY TOTAL	**839,857**	**839,656**	**839,364**	**839,157**	**838,911**	**838,673**

REUSE SOURCE TYPE				SOURCE AVAILABILITY (ACRE-FEET PER YEAR)					
SOURCE NAME	**COUNTY**	**BASIN**	**SALINITY ***	**2020**	**2030**	**2040**	**2050**	**2060**	**2070**
DIRECT REUSE	BREWSTER	RIO GRANDE	BRACKISH	193	193	193	193	193	193

* Salinity field indicates whether the source availability is considered ‘fresh’ (less than 1,000 mg/L), ‘brackish’ (1,000 to 10,000 mg/L), ‘saline’ (10,001 mg/L to 34,999 mg/L), or ‘seawater’ (35,000 mg/L or greater). Sources can also be labeled as ‘fresh/brackish’ or ‘brackish/saline’, if a combination of the salinity types is appropriate.

** Since reservoir sources can exist across multiple counties, the county field value, ‘reservoir’ is applied to all reservoir sources.

Region E Source Availability

REUSE SOURCE TYPE				SOURCE AVAILABILITY (ACRE-FEET PER YEAR)					
SOURCE NAME	**COUNTY**	**BASIN**	**SALINITY ***	**2020**	**2030**	**2040**	**2050**	**2060**	**2070**
DIRECT REUSE	EL PASO	RIO GRANDE	FRESH	19,748	21,025	22,150	23,374	24,530	25,836
INDIRECT REUSE	EL PASO	RIO GRANDE	FRESH	34,169	34,169	34,169	34,169	34,169	34,169
INDIRECT REUSE	HUDSPETH	RIO GRANDE	FRESH	334	334	334	334	334	334
REUSE SOURCE AVAILABILITY TOTAL				**54,444**	**55,721**	**56,846**	**58,070**	**59,226**	**60,532**

SURFACE WATER SOURCE TYPE				SOURCE AVAILABILITY (ACRE-FEET PER YEAR)					
SOURCE NAME	**COUNTY**	**BASIN**	**SALINITY ***	**2020**	**2030**	**2040**	**2050**	**2060**	**2070**
RIO GRANDE RUN-OF-RIVER	BREWSTER	RIO GRANDE	FRESH	7,774	7,774	7,774	7,774	7,774	7,774
RIO GRANDE RUN-OF-RIVER	EL PASO	RIO GRANDE	FRESH	46,605	46,605	46,605	46,605	46,605	46,605
RIO GRANDE RUN-OF-RIVER	HUDSPETH	RIO GRANDE	FRESH	725	725	725	725	725	725
RIO GRANDE RUN-OF-RIVER	PRESIDIO	RIO GRANDE	FRESH	10,218	10,218	10,218	10,218	10,218	10,218
RIO GRANDE RUN-OF-RIVER	TERRELL	RIO GRANDE	FRESH	441	441	441	441	441	441
SURFACE WATER SOURCE AVAILABILITY TOTAL				**65,763**	**65,763**	**65,763**	**65,763**	**65,763**	**65,763**

REGION E SOURCE AVAILABILITY TOTAL	**960,064**	**961,140**	**961,973**	**962,990**	**963,900**	**964,968**

* Salinity field indicates whether the source availability is considered 'fresh' (less than 1,000 mg/L), 'brackish' (1,000 to 10,000 mg/L), 'saline' (10,001 mg/L to 34,999 mg/L), or 'seawater' (35,000 mg/L or greater). Sources can also be labeled as 'fresh/brackish' or 'brackish/saline', if a combination of the salinity types is appropriate.

** Since reservoir sources can exist across multiple counties, the county field value, 'reservoir' is applied to all reservoir sources.

Region E Water User Group (WUG) Existing Water Supply

WUG NAME	SOURCE REGION	SOURCE DESCRIPTION	EXISTING SUPPLY (ACRE-FEET PER YEAR)					
			2020	2030	2040	2050	2060	2070
ALPINE	E	DIRECT REUSE	84	84	84	84	84	84
ALPINE	E	IGNEOUS AQUIFER | BREWSTER COUNTY	1,238	1,238	1,238	1,238	1,238	1,238
ALPINE	E	IGNEOUS AQUIFER | JEFF DAVIS COUNTY	1,234	1,234	1,234	1,234	1,234	1,234
LAJITAS MUNICIPAL SERVICES	E	OTHER AQUIFER | BREWSTER COUNTY	331	331	331	331	331	331
MARATHON WATER SUPPLY & SEWER SERVICE	E	MARATHON AQUIFER | BREWSTER COUNTY	242	242	242	242	242	242
COUNTY-OTHER	E	EDWARDS-TRINITY-PLATEAU AQUIFER | BREWSTER COUNTY	23	23	23	23	23	23
COUNTY-OTHER	E	IGNEOUS AQUIFER | BREWSTER COUNTY	446	446	446	446	446	446
COUNTY-OTHER	E	OTHER AQUIFER | BREWSTER COUNTY	217	217	217	217	217	217
LIVESTOCK	E	CAPITAN REEF COMPLEX AQUIFER | BREWSTER COUNTY	30	30	30	30	30	30
LIVESTOCK	E	EDWARDS-TRINITY-PLATEAU AQUIFER | BREWSTER COUNTY	97	97	97	97	97	97
LIVESTOCK	E	IGNEOUS AQUIFER | BREWSTER COUNTY	112	112	112	112	112	112
LIVESTOCK	E	MARATHON AQUIFER | BREWSTER COUNTY	15	15	15	15	15	15
LIVESTOCK	E	OTHER AQUIFER | BREWSTER COUNTY	112	112	112	112	112	112
IRRIGATION	E	IGNEOUS AQUIFER | BREWSTER COUNTY	291	291	291	291	291	291
IRRIGATION	E	MARATHON AQUIFER | BREWSTER COUNTY	309	309	309	309	309	309
IRRIGATION	E	OTHER AQUIFER | BREWSTER COUNTY	1,236	1,236	1,236	1,236	1,236	1,236
IRRIGATION	E	RIO GRANDE RUN-OF-RIVER	1,551	1,551	1,551	1,551	1,551	1,551
		RIO GRANDE BASIN TOTAL	**7,568**	**7,568**	**7,568**	**7,568**	**7,568**	**7,568**
		BREWSTER COUNTY TOTAL	**7,568**	**7,568**	**7,568**	**7,568**	**7,568**	**7,568**
VAN HORN	E	WEST TEXAS BOLSONS AQUIFER | CULBERSON COUNTY	1,016	1,016	1,016	1,016	1,016	1,016
COUNTY-OTHER	E	EDWARDS-TRINITY-PLATEAU AQUIFER | CULBERSON COUNTY	3	3	3	3	3	3
COUNTY-OTHER	E	RUSTLER AQUIFER | CULBERSON COUNTY	2	2	2	2	2	2
COUNTY-OTHER	E	WEST TEXAS BOLSONS AQUIFER | CULBERSON COUNTY	152	152	152	152	152	152
MANUFACTURING	E	WEST TEXAS BOLSONS AQUIFER | CULBERSON COUNTY	6	6	6	6	6	6
MINING	E	CAPITAN REEF COMPLEX AQUIFER | CULBERSON COUNTY	2,000	2,000	2,000	2,000	2,000	2,000
MINING	E	RUSTLER AQUIFER | CULBERSON COUNTY	0	0	0	0	0	0
MINING	E	WEST TEXAS BOLSONS AQUIFER | CULBERSON COUNTY	2,045	2,045	2,045	2,045	2,045	2,045
LIVESTOCK	E	CAPITAN REEF COMPLEX AQUIFER | CULBERSON COUNTY	55	55	55	55	55	55
LIVESTOCK	E	EDWARDS-TRINITY-PLATEAU AQUIFER | CULBERSON COUNTY	20	20	20	20	20	20
LIVESTOCK	E	IGNEOUS AQUIFER | CULBERSON COUNTY	15	15	15	15	15	15
LIVESTOCK	E	RUSTLER AQUIFER | CULBERSON COUNTY	31	31	31	31	31	31
LIVESTOCK	E	WEST TEXAS BOLSONS AQUIFER | CULBERSON COUNTY	164	164	164	164	164	164
IRRIGATION	E	CAPITAN REEF COMPLEX AQUIFER | CULBERSON COUNTY	5,525	5,525	0	0	0	0
IRRIGATION	E	WEST TEXAS BOLSONS AQUIFER | CULBERSON COUNTY	32,005	32,005	32,005	32,005	32,005	32,005
		RIO GRANDE BASIN TOTAL	**43,039**	**43,039**	**37,514**	**37,514**	**37,514**	**37,514**
		CULBERSON COUNTY TOTAL	**43,039**	**43,039**	**37,514**	**37,514**	**37,514**	**37,514**
ANTHONY	E	HUECO-MESILLA BOLSON AQUIFER | EL PASO COUNTY	1,532	1,532	1,532	1,532	1,532	1,532
EAST BIGGS WATER SYSTEM	E	HUECO-MESILLA BOLSON AQUIFER | EL PASO COUNTY	1,242	1,242	1,242	1,242	1,242	1,242
EAST MONTANA WATER SYSTEM	E	HUECO-MESILLA BOLSON AQUIFER | EL PASO COUNTY	1,241	1,241	1,241	1,241	1,241	1,241
EL PASO COUNTY TORNILLO WID	E	HUECO-MESILLA BOLSON AQUIFER | EL PASO COUNTY	807	807	807	807	807	807
EL PASO COUNTY WCID 4	E	HUECO-MESILLA BOLSON AQUIFER | EL PASO COUNTY	1,855	1,855	1,855	1,855	1,855	1,855

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Region E Water User Group (WUG) Existing Water Supply

WUG NAME	SOURCE REGION	SOURCE DESCRIPTION	EXISTING SUPPLY (ACRE-FEET PER YEAR)					
			2020	2030	2040	2050	2060	2070
EL PASO WATER	E	DIRECT REUSE	6,000	6,000	6,000	6,000	6,000	6,000
EL PASO WATER	E	HUECO-MESILLA BOLSON AQUIFER | EL PASO COUNTY	115,000	115,000	115,000	115,000	115,000	115,000
EL PASO WATER	E	RIO GRANDE RUN-OF-RIVER	10,000	10,000	10,000	10,000	10,000	10,000
FEDERAL CORRECTIONAL INSTITUTION LA TUNA	E	HUECO-MESILLA BOLSON AQUIFER | EL PASO COUNTY	2,016	2,016	2,016	2,016	2,016	2,016
FORT BLISS WATER SERVICES	E	HUECO-MESILLA BOLSON AQUIFER | EL PASO COUNTY	7,158	7,158	7,158	7,158	7,158	7,158
HACIENDAS DEL NORTE WID	E	HUECO-MESILLA BOLSON AQUIFER | EL PASO COUNTY	306	306	306	306	306	306
HORIZON REGIONAL MUD	E	HUECO-MESILLA BOLSON AQUIFER | EL PASO COUNTY	3,649	3,649	3,649	3,649	3,649	3,649
HORIZON REGIONAL MUD	E	OTHER AQUIFER | EL PASO COUNTY	1,578	1,578	1,578	1,578	1,578	1,578
LOWER VALLEY WATER DISTRICT	E	HUECO-MESILLA BOLSON AQUIFER | EL PASO COUNTY	4,356	4,356	4,356	4,356	4,356	4,356
PASEO DEL ESTE MUD 1	E	HUECO-MESILLA BOLSON AQUIFER | EL PASO COUNTY	1,629	1,629	1,629	1,629	1,629	1,629
COUNTY-OTHER | VINTON HILLS ESTATES	E	HUECO-MESILLA BOLSON AQUIFER | EL PASO COUNTY	120	120	120	120	120	120
COUNTY-OTHER | VINTON HILLS SUBDIVISION	E	HUECO-MESILLA BOLSON AQUIFER | EL PASO COUNTY	280	280	280	280	280	280
COUNTY-OTHER	E	HUECO-MESILLA BOLSON AQUIFER | EL PASO COUNTY	6,278	6,278	6,278	6,278	6,278	6,278
MANUFACTURING	E	HUECO-MESILLA BOLSON AQUIFER | EL PASO COUNTY	7,297	7,297	7,297	7,297	7,297	7,297
MINING	E	HUECO-MESILLA BOLSON AQUIFER | EL PASO COUNTY	810	810	810	810	810	810
MINING	E	OTHER AQUIFER | EL PASO COUNTY	1,347	1,347	1,347	1,347	1,347	1,347
STEAM ELECTRIC POWER	E	HUECO-MESILLA BOLSON AQUIFER | EL PASO COUNTY	3,285	3,285	3,285	3,285	3,285	3,285
LIVESTOCK	E	HUECO-MESILLA BOLSON AQUIFER | EL PASO COUNTY	205	205	205	205	205	205
LIVESTOCK	E	OTHER AQUIFER | EL PASO COUNTY	33	33	33	33	33	33
IRRIGATION	E	HUECO-MESILLA BOLSON AQUIFER | EL PASO COUNTY	7,392	7,392	7,392	7,392	7,392	7,392
IRRIGATION	E	OTHER AQUIFER | EL PASO COUNTY	30,000	30,000	30,000	30,000	30,000	30,000
IRRIGATION	E	RIO GRANDE INDIRECT REUSE	34,169	34,169	34,169	34,169	34,169	34,169
IRRIGATION	E	RIO GRANDE RUN-OF-RIVER	31,605	31,605	31,605	31,605	31,605	31,605
		RIO GRANDE BASIN TOTAL	**281,190**	**281,190**	**281,190**	**281,190**	**281,190**	**281,190**
		EL PASO COUNTY TOTAL	**281,190**	**281,190**	**281,190**	**281,190**	**281,190**	**281,190**
ESPERANZA WATER SERVICE	E	HUECO-MESILLA BOLSON AQUIFER | HUDSPETH COUNTY	484	484	484	484	484	484
HUDSPETH COUNTY WCID 1	E	WEST TEXAS BOLSONS AQUIFER | CULBERSON COUNTY	532	532	532	532	532	532
COUNTY-OTHER | DELL CITY	E	BONE SPRING-VICTORIO PEAK AQUIFER | HUDSPETH COUNTY	63	63	63	63	63	63
COUNTY-OTHER | FORT HANCOCK WCID	E	OTHER AQUIFER | HUDSPETH COUNTY	270	270	270	270	270	270
COUNTY-OTHER	E	HUECO-MESILLA BOLSON AQUIFER | HUDSPETH COUNTY	23	23	23	23	23	23
MINING	E	HUECO-MESILLA BOLSON AQUIFER | HUDSPETH COUNTY	52	52	52	52	52	52
MINING	E	OTHER AQUIFER | HUDSPETH COUNTY	21	21	21	21	21	21
MINING	E	WEST TEXAS BOLSONS AQUIFER | HUDSPETH COUNTY	210	210	210	210	210	210
LIVESTOCK	E	BONE SPRING-VICTORIO PEAK AQUIFER | HUDSPETH COUNTY	84	84	84	84	84	84
LIVESTOCK	E	CAPITAN REEF COMPLEX AQUIFER | HUDSPETH COUNTY	7	7	7	7	7	7
LIVESTOCK	E	HUECO-MESILLA BOLSON AQUIFER | HUDSPETH COUNTY	11	11	11	11	11	11
LIVESTOCK	E	OTHER AQUIFER | HUDSPETH COUNTY	281	281	281	281	281	281
LIVESTOCK	E	WEST TEXAS BOLSONS AQUIFER | HUDSPETH COUNTY	77	77	77	77	77	77
IRRIGATION	E	BONE SPRING-VICTORIO PEAK AQUIFER | HUDSPETH COUNTY	68,495	68,495	68,495	68,495	68,495	68,495
IRRIGATION	E	CAPITAN REEF COMPLEX AQUIFER | HUDSPETH COUNTY	4,213	4,213	4,213	4,213	4,213	4,213

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Region E Water User Group (WUG) Existing Water Supply

WUG NAME	SOURCE REGION	SOURCE DESCRIPTION	EXISTING SUPPLY (ACRE-FEET PER YEAR)					
			2020	2030	2040	2050	2060	2070
IRRIGATION	E	OTHER AQUIFER | HUDSPETH COUNTY	52,187	52,187	52,187	52,187	52,187	52,187
IRRIGATION	E	RIO GRANDE INDIRECT REUSE	334	334	334	334	334	334
IRRIGATION	E	RIO GRANDE RUN-OF-RIVER	725	725	725	725	725	725
		RIO GRANDE BASIN TOTAL	**128,069**	**128,069**	**128,069**	**128,069**	**128,069**	**128,069**
		HUDSPETH COUNTY TOTAL	**128,069**	**128,069**	**128,069**	**128,069**	**128,069**	**128,069**
FORT DAVIS WSC	E	IGNEOUS AQUIFER | JEFF DAVIS COUNTY	468	468	468	468	468	468
COUNTY-OTHER | CITY OF VALENTINE	E	WEST TEXAS BOLSONS AQUIFER | JEFF DAVIS COUNTY	29	29	29	29	29	29
COUNTY-OTHER	E	IGNEOUS AQUIFER | JEFF DAVIS COUNTY	315	315	315	315	315	315
MINING	E	IGNEOUS AQUIFER | JEFF DAVIS COUNTY	153	153	153	153	153	153
LIVESTOCK	E	EDWARDS-TRINITY-PLATEAU AND PECOS VALLEY AQUIFERS | JEFF DAVIS COUNTY	108	108	108	108	108	108
LIVESTOCK	E	IGNEOUS AQUIFER | JEFF DAVIS COUNTY	299	299	299	299	299	299
LIVESTOCK	E	WEST TEXAS BOLSONS AQUIFER | JEFF DAVIS COUNTY	63	63	63	63	63	63
IRRIGATION	E	EDWARDS-TRINITY-PLATEAU AND PECOS VALLEY AQUIFERS | JEFF DAVIS COUNTY	70	70	70	70	70	70
IRRIGATION	E	IGNEOUS AQUIFER | JEFF DAVIS COUNTY	735	735	735	735	735	735
IRRIGATION	E	WEST TEXAS BOLSONS AQUIFER | JEFF DAVIS COUNTY	561	561	561	561	561	561
		RIO GRANDE BASIN TOTAL	**2,801**	**2,801**	**2,801**	**2,801**	**2,801**	**2,801**
		JEFF DAVIS COUNTY TOTAL	**2,801**	**2,801**	**2,801**	**2,801**	**2,801**	**2,801**
MARFA	E	IGNEOUS AQUIFER | PRESIDIO COUNTY	2,097	2,097	2,097	2,097	2,097	2,097
PRESIDIO	E	WEST TEXAS BOLSONS AQUIFER | PRESIDIO COUNTY	3,766	3,766	3,766	3,766	3,766	3,766
COUNTY-OTHER	E	IGNEOUS AQUIFER | PRESIDIO COUNTY	289	289	289	289	289	289
COUNTY-OTHER	E	WEST TEXAS BOLSONS AQUIFER | PRESIDIO COUNTY	193	193	193	193	193	193
MINING	E	WEST TEXAS BOLSONS AQUIFER | PRESIDIO COUNTY	403	403	403	403	403	403
LIVESTOCK	E	IGNEOUS AQUIFER | PRESIDIO COUNTY	224	224	224	224	224	224
LIVESTOCK	E	WEST TEXAS BOLSONS AQUIFER | PRESIDIO COUNTY	142	142	142	142	142	142
IRRIGATION	E	IGNEOUS AQUIFER | PRESIDIO COUNTY	605	605	605	605	605	605
IRRIGATION	E	RIO GRANDE RUN-OF-RIVER	6,140	6,140	6,140	6,140	6,140	6,140
IRRIGATION	E	WEST TEXAS BOLSONS AQUIFER | PRESIDIO COUNTY	2,256	2,256	2,256	2,256	2,256	2,256
		RIO GRANDE BASIN TOTAL	**16,115**	**16,115**	**16,115**	**16,115**	**16,115**	**16,115**
		PRESIDIO COUNTY TOTAL	**16,115**	**16,115**	**16,115**	**16,115**	**16,115**	**16,115**
TERRELL COUNTY WCID 1	E	EDWARDS-TRINITY-PLATEAU, PECOS VALLEY, AND TRINITY AQUIFERS | TERRELL COUNTY	476	476	476	476	476	476
COUNTY-OTHER	E	EDWARDS-TRINITY-PLATEAU, PECOS VALLEY, AND TRINITY AQUIFERS | TERRELL COUNTY	75	75	75	75	75	75
MINING	E	EDWARDS-TRINITY-PLATEAU, PECOS VALLEY, AND TRINITY AQUIFERS | TERRELL COUNTY	190	190	190	190	190	190
LIVESTOCK	E	EDWARDS-TRINITY-PLATEAU, PECOS VALLEY, AND TRINITY AQUIFERS | TERRELL COUNTY	206	206	206	206	206	206
IRRIGATION	E	EDWARDS-TRINITY-PLATEAU, PECOS VALLEY, AND TRINITY AQUIFERS | TERRELL COUNTY	473	473	473	473	473	473
IRRIGATION	E	RIO GRANDE RUN-OF-RIVER	441	441	441	441	441	441
		RIO GRANDE BASIN TOTAL	**1,861**	**1,861**	**1,861**	**1,861**	**1,861**	**1,861**
		TERRELL COUNTY TOTAL	**1,861**	**1,861**	**1,861**	**1,861**	**1,861**	**1,861**
		REGION E EXISTING WATER SUPPLY TOTAL	**480,643**	**480,643**	**475,118**	**475,118**	**475,118**	**475,118**

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Region E Water User Group (WUG) Needs/Surplus

WUG supplies and projected demands are entered for each of a WUG's region-county-basin divisions. The needs shown in the WUG Needs/Surplus report are calculated by first deducting the WUG split's projected demand from its total existing water supply volume. If the WUG split has a greater existing supply volume than projected demand in any given decade, this amount is considered a surplus volume. Surplus volumes are shown as positive values, and needs are shown as negative values in parentheses.

	(NEEDS)/SURPLUS (ACRE-FEET PER YEAR)					
	2020	2030	2040	2050	2060	2070
BREWSTER COUNTY - RIO GRANDE BASIN						
ALPINE	622	612	621	623	619	616
LAJITAS MUNICIPAL SERVICES	228	227	228	228	227	227
MARATHON WATER SUPPLY & SEWER SERVICE	118	116	116	115	115	115
COUNTY-OTHER	275	255	253	250	247	244
LIVESTOCK	19	19	19	19	19	19
IRRIGATION	1,381	1,381	1,381	1,381	1,381	1,381
CULBERSON COUNTY - RIO GRANDE BASIN						
VAN HORN	354	305	279	256	242	233
COUNTY-OTHER	92	88	86	84	83	82
MANUFACTURING	1	0	0	0	0	0
MINING	1,926	1,192	1,039	1,322	1,589	1,792
LIVESTOCK	15	15	15	15	15	15
IRRIGATION	(333)	(333)	(5,858)	(5,858)	(5,858)	(5,858)
EL PASO COUNTY - RIO GRANDE BASIN						
ANTHONY	762	627	499	369	241	120
EAST BIGGS WATER SYSTEM	444	444	444	444	444	444
EAST MONTANA WATER SYSTEM	435	350	267	177	86	0
EL PASO COUNTY TORNILLO WID	487	495	501	504	504	503
EL PASO COUNTY WCID 4	1,045	1,062	1,074	1,072	1,057	1,039
EL PASO WATER	20,428	10,685	1,287	(8,978)	(19,601)	(29,792)
FEDERAL CORRECTIONAL INSTITUTION LA TUNA	1,664	1,671	1,674	1,676	1,677	1,677
FORT BLISS WATER SERVICES	2,277	2,237	2,134	1,976	1,827	1,677
HACIENDAS DEL NORTE WID	110	88	66	44	21	0
HORIZON REGIONAL MUD	(2,709)	(5,816)	(8,735)	(11,641)	(14,403)	(17,008)
LOWER VALLEY WATER DISTRICT	(1,358)	(2,207)	(3,042)	(3,934)	(4,833)	(5,689)
PASEO DEL ESTE MUD 1	575	462	351	232	114	0
COUNTY-OTHER | VINTON HILLS ESTATES	56	35	16	(4)	(24)	(42)
COUNTY-OTHER | VINTON HILLS SUBDIVISION	131	83	38	(10)	(54)	(96)
COUNTY-OTHER	4,192	3,520	2,883	2,223	1,598	1,006
MANUFACTURING	269	(860)	(860)	(860)	(860)	(860)
MINING	(1,851)	(2,469)	(3,105)	(3,791)	(4,536)	(5,382)
STEAM ELECTRIC POWER	(7,260)	(7,260)	(7,260)	(7,260)	(7,260)	(7,260)
LIVESTOCK	67	67	67	67	67	67
IRRIGATION	(46,404)	(46,404)	(46,404)	(46,404)	(46,404)	(46,404)
HUDSPETH COUNTY - RIO GRANDE BASIN						
ESPERANZA WATER SERVICE	342	332	331	330	329	328
HUDSPETH COUNTY WCID 1	390	381	380	379	378	377
COUNTY-OTHER | DELL CITY	18	16	16	16	16	16
COUNTY-OTHER | FORT HANCOCK WCID	156	151	151	151	150	149
COUNTY-OTHER	(35)	(38)	(38)	(38)	(38)	(39)
MINING	(196)	(168)	(185)	(200)	(209)	(219)
LIVESTOCK	23	23	23	23	23	23
IRRIGATION	10,412	10,412	10,412	10,412	10,412	10,412

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Region E Water User Group (WUG) Needs/Surplus

JEFF DAVIS COUNTY - RIO GRANDE BASIN						
FORT DAVIS WSC	149	154	159	161	161	161
COUNTY-OTHER | CITY OF VALENTINE	0	1	1	2	2	2
COUNTY-OTHER	191	195	198	200	200	200
MINING	0	0	0	0	0	0
LIVESTOCK	73	73	73	73	73	73
IRRIGATION	701	701	701	701	701	701
PRESIDIO COUNTY - RIO GRANDE BASIN						
MARFA	1,407	1,362	1,316	1,256	1,202	1,150
PRESIDIO	3,028	2,994	2,958	2,910	2,861	2,813
COUNTY-OTHER	382	370	359	343	329	316
MINING	0	403	403	403	403	403
LIVESTOCK	38	38	38	38	38	38
IRRIGATION	4,995	4,995	4,995	4,995	4,995	4,995
TERRELL COUNTY - RIO GRANDE BASIN						
TERRELL COUNTY WCID 1	298	298	298	299	299	299
COUNTY-OTHER	54	54	55	55	55	55
MINING	(483)	(586)	(550)	(416)	(293)	(195)
LIVESTOCK	55	55	55	55	55	55
IRRIGATION	163	163	163	163	163	163

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Region E Water User Group (WUG) Second-Tier Identified Water Needs

Second-tier needs are WUG split needs adjusted to include the implementation of recommended demand reduction and direct reuse water management strategies.

	WUG SECOND-TIER NEEDS (ACRE-FEET PER YEAR)					
	2020	2030	2040	2050	2060	2070
BREWSTER COUNTY - RIO GRANDE BASIN						
ALPINE	0	0	0	0	0	0
LAJITAS MUNICIPAL SERVICES	0	0	0	0	0	0
MARATHON WATER SUPPLY & SEWER SERVICE	0	0	0	0	0	0
COUNTY-OTHER	0	0	0	0	0	0
LIVESTOCK	0	0	0	0	0	0
IRRIGATION	0	0	0	0	0	0
CULBERSON COUNTY - RIO GRANDE BASIN						
VAN HORN	0	0	0	0	0	0
COUNTY-OTHER	0	0	0	0	0	0
MANUFACTURING	0	0	0	0	0	0
MINING	0	0	0	0	0	0
LIVESTOCK	0	0	0	0	0	0
IRRIGATION	226	226	5,751	5,751	5,751	5,751
EL PASO COUNTY - RIO GRANDE BASIN						
ANTHONY	0	0	0	0	0	0
EAST BIGGS WATER SYSTEM	0	0	0	0	0	0
EAST MONTANA WATER SYSTEM	0	0	0	0	0	0
EL PASO COUNTY TORNILLO WID	0	0	0	0	0	0
EL PASO COUNTY WCID 4	0	0	0	0	0	0
EL PASO WATER	0	0	0	0	0	1,372
FEDERAL CORRECTIONAL INSTITUTION LA TUNA	0	0	0	0	0	0
FORT BLISS WATER SERVICES	0	0	0	0	0	0
HACIENDAS DEL NORTE WID	0	0	0	0	0	0
HORIZON REGIONAL MUD	2,433	5,432	8,249	11,054	13,720	16,235
LOWER VALLEY WATER DISTRICT	1,301	2,141	2,968	3,851	4,741	5,589
PASEO DEL ESTE MUD 1	0	0	0	0	0	0
COUNTY-OTHER	0	0	0	0	0	0
COUNTY-OTHER | VINTON HILLS ESTATES	0	0	0	3	23	41
COUNTY-OTHER | VINTON HILLS SUBDIVISION	0	0	0	7	50	92
MANUFACTURING	0	860	860	860	860	860
MINING	1,851	2,469	3,105	3,791	4,536	5,382
STEAM ELECTRIC POWER	7,260	7,260	7,260	7,260	7,260	7,260
LIVESTOCK	0	0	0	0	0	0
IRRIGATION	17,941	17,941	17,941	17,941	17,941	17,941
HUDSPETH COUNTY - RIO GRANDE BASIN						
ESPERANZA WATER SERVICE	0	0	0	0	0	0
HUDSPETH COUNTY WCID 1	0	0	0	0	0	0
COUNTY-OTHER	34	36	36	36	36	37
COUNTY-OTHER | DELL CITY	0	0	0	0	0	0
COUNTY-OTHER | FORT HANCOCK WCID	0	0	0	0	0	0
MINING	196	168	185	200	209	219
LIVESTOCK	0	0	0	0	0	0
IRRIGATION	0	0	0	0	0	0

*A single asterisk next to a WUG's name denotes that the WUG is split by two or more planning regions.

Region E Water User Group (WUG) Second-Tier Identified Water Needs

	WUG SECOND-TIER NEEDS (ACRE-FEET PER YEAR)					
	2020	2030	2040	2050	2060	2070
JEFF DAVIS COUNTY - RIO GRANDE BASIN						
FORT DAVIS WSC	0	0	0	0	0	0
COUNTY-OTHER	0	0	0	0	0	0
COUNTY-OTHER | CITY OF VALENTINE	0	0	0	0	0	0
MINING	0	0	0	0	0	0
LIVESTOCK	0	0	0	0	0	0
IRRIGATION	0	0	0	0	0	0
PRESIDIO COUNTY - RIO GRANDE BASIN						
MARFA	0	0	0	0	0	0
PRESIDIO	0	0	0	0	0	0
COUNTY-OTHER	0	0	0	0	0	0
MINING	0	0	0	0	0	0
LIVESTOCK	0	0	0	0	0	0
IRRIGATION	0	0	0	0	0	0
TERRELL COUNTY - RIO GRANDE BASIN						
TERRELL COUNTY WCID 1	0	0	0	0	0	0
COUNTY-OTHER	0	0	0	0	0	0
MINING	483	586	550	416	293	195
LIVESTOCK	0	0	0	0	0	0
IRRIGATION	0	0	0	0	0	0

*A single asterisk next to a WUG's name denotes that the WUG is split by two or more planning regions.

Region E Water User Group (WUG) Second-Tier Identified Water Needs Summary

Second-tier needs are WUG split needs adjusted to include the implementation of recommended demand reduction and direct reuse water management strategies.

WUG CATEGORY	NEEDS (ACRE-FEET PER YEAR)					
	2020	2030	2040	2050	2060	2070
MUNICIPAL	3,734	7,573	11,217	14,905	18,461	23,196
COUNTY-OTHER	34	36	36	46	109	170
MANUFACTURING	0	860	860	860	860	860
MINING	2,530	3,223	3,840	4,407	5,038	5,796
STEAM ELECTRIC POWER	7,260	7,260	7,260	7,260	7,260	7,260
LIVESTOCK	0	0	0	0	0	0
IRRIGATION	18,167	18,167	23,692	23,692	23,692	23,692

Region E Source Water Balance (Availability - WUG Supply)

GROUNDWATER SOURCE TYPE				SOURCE WATER BALANCE (ACRE-FEET PER YEAR)					
SOURCE NAME	**COUNTY**	**BASIN**	**SALINITY***	**2020**	**2030**	**2040**	**2050**	**2060**	**2070**
BONE SPRING-VICTORIO PEAK AQUIFER	HUDSPETH	RIO GRANDE	FRESH/ BRACKISH	32,758	32,758	32,758	32,758	32,758	32,758
CAPITAN REEF COMPLEX AQUIFER	BREWSTER	RIO GRANDE	FRESH/ BRACKISH	553	553	553	553	553	553
CAPITAN REEF COMPLEX AQUIFER	CULBERSON	RIO GRANDE	FRESH/ BRACKISH	0	0	5,525	5,525	5,525	5,525
CAPITAN REEF COMPLEX AQUIFER	HUDSPETH	RIO GRANDE	FRESH/ BRACKISH	4,475	4,475	4,475	4,475	4,475	4,475
CAPITAN REEF COMPLEX AQUIFER	JEFF DAVIS	RIO GRANDE	FRESH	0	0	0	0	0	0
EDWARDS-TRINITY-PLATEAU AND PECOS VALLEY AQUIFERS	JEFF DAVIS	RIO GRANDE	FRESH	0	0	0	0	0	0
EDWARDS-TRINITY-PLATEAU AQUIFER	BREWSTER	RIO GRANDE	FRESH/ BRACKISH	1,274	1,274	1,274	1,274	1,274	1,274
EDWARDS-TRINITY-PLATEAU AQUIFER	CULBERSON	RIO GRANDE	FRESH	376	376	376	376	376	376
EDWARDS-TRINITY-PLATEAU, PECOS VALLEY, AND TRINITY AQUIFERS	TERRELL	RIO GRANDE	FRESH	0	0	0	0	0	0
HUECO-MESILLA BOLSON AQUIFER	EL PASO	RIO GRANDE	FRESH/ BRACKISH	268,542	268,542	268,542	268,542	268,542	268,542
HUECO-MESILLA BOLSON AQUIFER	HUDSPETH	RIO GRANDE	FRESH/ BRACKISH	44,430	44,430	44,430	44,430	44,430	44,430
IGNEOUS AQUIFER	BREWSTER	RIO GRANDE	FRESH	499	499	498	496	496	495
IGNEOUS AQUIFER	CULBERSON	RIO GRANDE	FRESH	84	84	84	84	84	84
IGNEOUS AQUIFER	JEFF DAVIS	RIO GRANDE	FRESH	644	644	644	644	644	644
IGNEOUS AQUIFER	PRESIDIO	RIO GRANDE	FRESH	849	849	849	848	848	848
MARATHON AQUIFER	BREWSTER	RIO GRANDE	FRESH	6,761	6,761	6,761	6,761	6,761	6,761
OTHER AQUIFER	BREWSTER	RIO GRANDE	FRESH	0	0	0	0	0	0
OTHER AQUIFER	EL PASO	RIO GRANDE	BRACKISH	24,964	24,964	24,964	24,964	24,964	24,964
OTHER AQUIFER	HUDSPETH	RIO GRANDE	BRACKISH	0	0	0	0	0	0
OTHER AQUIFER	HUDSPETH	RIO GRANDE	FRESH	26,119	26,119	26,119	26,119	26,119	26,119
RUSTLER AQUIFER	BREWSTER	RIO GRANDE	BRACKISH/SALI NE	0	0	0	0	0	0
RUSTLER AQUIFER	CULBERSON	RIO GRANDE	BRACKISH/SALI NE	20	20	20	20	20	20
RUSTLER AQUIFER	JEFF DAVIS	RIO GRANDE	FRESH	0	0	0	0	0	0
WEST TEXAS BOLSONS AQUIFER	CULBERSON	RIO GRANDE	BRACKISH	16,340	16,340	16,340	16,340	16,340	16,340
WEST TEXAS BOLSONS AQUIFER	CULBERSON	RIO GRANDE	FRESH/ BRACKISH	340	269	192	141	67	0
WEST TEXAS BOLSONS AQUIFER	HUDSPETH	RIO GRANDE	BRACKISH	219	219	219	219	219	219
WEST TEXAS BOLSONS AQUIFER	HUDSPETH	RIO GRANDE	FRESH/ BRACKISH	4,505	4,505	4,505	4,505	4,505	4,505
WEST TEXAS BOLSONS AQUIFER	JEFF DAVIS	RIO GRANDE	FRESH/ BRACKISH	5,484	5,484	5,418	5,389	5,356	5,321
WEST TEXAS BOLSONS AQUIFER	PRESIDIO	RIO GRANDE	FRESH	7,887	7,757	7,609	7,485	7,346	7,211
WEST TEXAS BOLSONS AQUIFER	PRESIDIO	RIO GRANDE	FRESH/ BRACKISH	2,208	2,208	2,208	2,208	2,208	2,208
GROUNDWATER SOURCE WATER BALANCE TOTAL				**449,331**	**449,130**	**454,363**	**454,156**	**453,910**	**453,672**

REUSE SOURCE TYPE				SOURCE WATER BALANCE (ACRE-FEET PER YEAR)					
SOURCE NAME	**COUNTY**	**BASIN**	**SALINITY***	**2020**	**2030**	**2040**	**2050**	**2060**	**2070**
DIRECT REUSE	BREWSTER	RIO GRANDE	BRACKISH	84	84	84	84	84	84

* Salinity field indicates whether the source availability is considered 'fresh' (less than 1,000 mg/L), 'brackish' (1,000 to 10,000 mg/L), 'saline' (10,001 mg/L to 34,999 mg/L), or 'seawater' (35,000 mg/L or greater). Sources can also be labeled as 'fresh/brackish' or 'brackish/saline', if a combination of the salinity types is appropriate.

** Since reservoir sources can exist across multiple counties, the county field value, 'reservoir' is applied to all reservoir sources.

Region E Source Water Balance (Availability - WUG Supply)

REUSE SOURCE TYPE				SOURCE WATER BALANCE (ACRE-FEET PER YEAR)					
SOURCE NAME	**COUNTY**	**BASIN**	**SALINITY***	**2020**	**2030**	**2040**	**2050**	**2060**	**2070**
DIRECT REUSE	EL PASO	RIO GRANDE	FRESH	6,000	6,000	6,000	6,000	6,000	6,000
INDIRECT REUSE	EL PASO	RIO GRANDE	FRESH	0	0	0	0	0	0
INDIRECT REUSE	HUDSPETH	RIO GRANDE	FRESH	0	0	0	0	0	0
REUSE SOURCE WATER BALANCE TOTAL				**6,084**	**6,084**	**6,084**	**6,084**	**6,084**	**6,084**

SURFACE WATER SOURCE TYPE				SOURCE WATER BALANCE (ACRE-FEET PER YEAR)					
SOURCE NAME	**COUNTY**	**BASIN**	**SALINITY***	**2020**	**2030**	**2040**	**2050**	**2060**	**2070**
RIO GRANDE RUN-OF-RIVER	BREWSTER	RIO GRANDE	FRESH	6,223	6,223	6,223	6,223	6,223	6,223
RIO GRANDE RUN-OF-RIVER	EL PASO	RIO GRANDE	FRESH	0	0	0	0	0	0
RIO GRANDE RUN-OF-RIVER	HUDSPETH	RIO GRANDE	FRESH	0	0	0	0	0	0
RIO GRANDE RUN-OF-RIVER	PRESIDIO	RIO GRANDE	FRESH	4,078	4,078	4,078	4,078	4,078	4,078
RIO GRANDE RUN-OF-RIVER	TERRELL	RIO GRANDE	FRESH	0	0	0	0	0	0
SURFACE WATER SOURCE WATER BALANCE TOTAL				**10,301**	**10,301**	**10,301**	**10,301**	**10,301**	**10,301**

REGION E SOURCE WATER BALANCE TOTAL	**465,716**	**465,515**	**470,748**	**470,541**	**470,295**	**470,057**

* Salinity field indicates whether the source availability is considered 'fresh' (less than 1,000 mg/L), 'brackish' (1,000 to 10,000 mg/L), 'saline' (10,001 mg/L to 34,999 mg/L), or 'seawater' (35,000 mg/L or greater). Sources can also be labeled as 'fresh/brackish' or 'brackish/saline', if a combination of the salinity types is appropriate.

** Since reservoir sources can exist across multiple counties, the county field value, 'reservoir' is applied to all reservoir sources.

Region E Water User Group (WUG) Data Comparison to 2016 Regional Water Plan (RWP)

	2020 PLANNING DECADE			2070 PLANNING DECADE		
	2016 RWP	2021 RWP	DIFFERENCE (%)	2016 RWP	2021 RWP	DIFFERENCE (%)
BREWSTER COUNTY | COUNTY-OTHER WUG TYPE						
EXISTING WUG SUPPLY TOTAL (acre-feet per year)	1,066	686	-35.6%	1,066	686	-35.6%
PROJECTED DEMAND TOTAL (acre-feet per year)	563	411	-27.0%	594	442	-25.6%
WATER SUPPLY NEEDS TOTAL (acre-feet per year)*	0	0	0.0%	0	0	0.0%
BREWSTER COUNTY | IRRIGATION WUG TYPE						
EXISTING WUG SUPPLY TOTAL (acre-feet per year)	3,272	3,387	3.5%	3,272	3,387	3.5%
PROJECTED DEMAND TOTAL (acre-feet per year)	2,304	2,006	-12.9%	2,247	2,006	-10.7%
WATER SUPPLY NEEDS TOTAL (acre-feet per year)*	0	0	0.0%	0	0	0.0%
BREWSTER COUNTY | LIVESTOCK WUG TYPE						
EXISTING WUG SUPPLY TOTAL (acre-feet per year)	386	366	-5.2%	386	366	-5.2%
PROJECTED DEMAND TOTAL (acre-feet per year)	386	347	-10.1%	386	347	-10.1%
WATER SUPPLY NEEDS TOTAL (acre-feet per year)*	0	0	0.0%	0	0	0.0%
BREWSTER COUNTY | MANUFACTURING WUG TYPE						
EXISTING WUG SUPPLY TOTAL (acre-feet per year)	4	0	-100.0%	4	0	-100.0%
PROJECTED DEMAND TOTAL (acre-feet per year)	4	0	-100.0%	4	0	-100.0%
WATER SUPPLY NEEDS TOTAL (acre-feet per year)*	0	0	0.0%	0	0	0.0%
BREWSTER COUNTY | MUNICIPAL WUG TYPE						
EXISTING WUG SUPPLY TOTAL (acre-feet per year)	2,166	3,129	44.5%	2,166	3,129	44.5%
PROJECTED DEMAND TOTAL (acre-feet per year)	1,935	2,161	11.7%	1,940	2,171	11.9%
WATER SUPPLY NEEDS TOTAL (acre-feet per year)*	0	0	0.0%	0	0	0.0%
CULBERSON COUNTY | COUNTY-OTHER WUG TYPE						
EXISTING WUG SUPPLY TOTAL (acre-feet per year)	140	157	12.1%	140	157	12.1%
PROJECTED DEMAND TOTAL (acre-feet per year)	65	65	0.0%	75	75	0.0%
WATER SUPPLY NEEDS TOTAL (acre-feet per year)*	0	0	0.0%	0	0	0.0%
CULBERSON COUNTY | IRRIGATION WUG TYPE						
EXISTING WUG SUPPLY TOTAL (acre-feet per year)	39,985	37,530	-6.1%	39,985	32,005	-20.0%
PROJECTED DEMAND TOTAL (acre-feet per year)	39,928	37,863	-5.2%	35,835	37,863	5.7%
WATER SUPPLY NEEDS TOTAL (acre-feet per year)*	0	333	100.0%	0	5,858	100.0%
CULBERSON COUNTY | LIVESTOCK WUG TYPE						
EXISTING WUG SUPPLY TOTAL (acre-feet per year)	300	285	-5.0%	300	285	-5.0%
PROJECTED DEMAND TOTAL (acre-feet per year)	300	270	-10.0%	300	270	-10.0%
WATER SUPPLY NEEDS TOTAL (acre-feet per year)*	0	0	0.0%	0	0	0.0%
CULBERSON COUNTY | MANUFACTURING WUG TYPE						
EXISTING WUG SUPPLY TOTAL (acre-feet per year)	0	6	100.0%	0	6	100.0%
PROJECTED DEMAND TOTAL (acre-feet per year)	0	5	100.0%	0	6	100.0%
WATER SUPPLY NEEDS TOTAL (acre-feet per year)*	0	0	0.0%	0	0	0.0%
CULBERSON COUNTY | MINING WUG TYPE						
EXISTING WUG SUPPLY TOTAL (acre-feet per year)	215	4,045	1781.4%	215	4,045	1781.4%
PROJECTED DEMAND TOTAL (acre-feet per year)	506	2,119	318.8%	640	2,253	252.0%
WATER SUPPLY NEEDS TOTAL (acre-feet per year)*	291	0	-100.0%	425	0	-100.0%
CULBERSON COUNTY | MUNICIPAL WUG TYPE						
EXISTING WUG SUPPLY TOTAL (acre-feet per year)	1,351	1,016	-24.8%	1,351	1,016	-24.8%
PROJECTED DEMAND TOTAL (acre-feet per year)	662	662	0.0%	784	783	-0.1%
WATER SUPPLY NEEDS TOTAL (acre-feet per year)*	0	0	0.0%	0	0	0.0%

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Region E Water User Group (WUG) Data Comparison to 2016 Regional Water Plan (RWP)

	2020 PLANNING DECADE			2070 PLANNING DECADE		
	2016 RWP	2021 RWP	DIFFERENCE (%)	2016 RWP	2021 RWP	DIFFERENCE (%)
EL PASO COUNTY | COUNTY-OTHER WUG TYPE						
EXISTING WUG SUPPLY TOTAL (acre-feet per year)	6,278	6,678	6.4%	6,278	6,678	6.4%
PROJECTED DEMAND TOTAL (acre-feet per year)	6,646	2,299	-65.4%	9,023	5,810	-35.6%
WATER SUPPLY NEEDS TOTAL (acre-feet per year)*	368	0	-100.0%	2,745	138	-95.0%
EL PASO COUNTY | IRRIGATION WUG TYPE						
EXISTING WUG SUPPLY TOTAL (acre-feet per year)	167,633	103,166	-38.5%	174,328	103,166	-40.8%
PROJECTED DEMAND TOTAL (acre-feet per year)	242,798	149,570	-38.4%	221,162	149,570	-32.4%
WATER SUPPLY NEEDS TOTAL (acre-feet per year)*	75,165	46,404	-38.3%	46,834	46,404	-0.9%
EL PASO COUNTY | LIVESTOCK WUG TYPE						
EXISTING WUG SUPPLY TOTAL (acre-feet per year)	629	238	-62.2%	629	238	-62.2%
PROJECTED DEMAND TOTAL (acre-feet per year)	629	171	-72.8%	629	171	-72.8%
WATER SUPPLY NEEDS TOTAL (acre-feet per year)*	0	0	0.0%	0	0	0.0%
EL PASO COUNTY | MANUFACTURING WUG TYPE						
EXISTING WUG SUPPLY TOTAL (acre-feet per year)	7,297	7,297	0.0%	7,297	7,297	0.0%
PROJECTED DEMAND TOTAL (acre-feet per year)	16,138	7,028	-56.5%	22,347	8,157	-63.5%
WATER SUPPLY NEEDS TOTAL (acre-feet per year)*	8,841	0	-100.0%	15,050	860	-94.3%
EL PASO COUNTY | MINING WUG TYPE						
EXISTING WUG SUPPLY TOTAL (acre-feet per year)	5,706	2,157	-62.2%	5,706	2,157	-62.2%
PROJECTED DEMAND TOTAL (acre-feet per year)	4,008	4,008	0.0%	7,539	7,539	0.0%
WATER SUPPLY NEEDS TOTAL (acre-feet per year)*	0	1,851	100.0%	1,833	5,382	193.6%
EL PASO COUNTY | MUNICIPAL WUG TYPE						
EXISTING WUG SUPPLY TOTAL (acre-feet per year)	145,803	158,369	8.6%	145,803	158,369	8.6%
PROJECTED DEMAND TOTAL (acre-feet per year)	129,266	134,209	3.8%	200,292	205,398	2.5%
WATER SUPPLY NEEDS TOTAL (acre-feet per year)*	5,255	4,067	-22.6%	55,266	52,489	-5.0%
EL PASO COUNTY | STEAM ELECTRIC POWER WUG TYPE						
EXISTING WUG SUPPLY TOTAL (acre-feet per year)	3,286	3,285	0.0%	3,286	3,285	0.0%
PROJECTED DEMAND TOTAL (acre-feet per year)	6,937	10,545	52.0%	15,937	10,545	-33.8%
WATER SUPPLY NEEDS TOTAL (acre-feet per year)*	3,651	7,260	98.8%	12,651	7,260	-42.6%
HUDSPETH COUNTY | COUNTY-OTHER WUG TYPE						
EXISTING WUG SUPPLY TOTAL (acre-feet per year)	916	356	-61.1%	916	356	-61.1%
PROJECTED DEMAND TOTAL (acre-feet per year)	347	217	-37.5%	368	230	-37.5%
WATER SUPPLY NEEDS TOTAL (acre-feet per year)*	0	35	100.0%	0	39	100.0%
HUDSPETH COUNTY | IRRIGATION WUG TYPE						
EXISTING WUG SUPPLY TOTAL (acre-feet per year)	83,993	125,954	50.0%	83,993	125,954	50.0%
PROJECTED DEMAND TOTAL (acre-feet per year)	178,840	115,542	-35.4%	161,053	115,542	-28.3%
WATER SUPPLY NEEDS TOTAL (acre-feet per year)*	94,847	0	-100.0%	77,060	0	-100.0%
HUDSPETH COUNTY | LIVESTOCK WUG TYPE						
EXISTING WUG SUPPLY TOTAL (acre-feet per year)	541	460	-15.0%	541	460	-15.0%
PROJECTED DEMAND TOTAL (acre-feet per year)	541	437	-19.2%	541	437	-19.2%
WATER SUPPLY NEEDS TOTAL (acre-feet per year)*	0	0	0.0%	0	0	0.0%
HUDSPETH COUNTY | MANUFACTURING WUG TYPE						
EXISTING WUG SUPPLY TOTAL (acre-feet per year)	10	0	-100.0%	10	0	-100.0%
PROJECTED DEMAND TOTAL (acre-feet per year)	2	0	-100.0%	2	0	-100.0%
WATER SUPPLY NEEDS TOTAL (acre-feet per year)*	0	0	0.0%	0	0	0.0%

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Region E Water User Group (WUG) Data Comparison to 2016 Regional Water Plan (RWP)

	2020 PLANNING DECADE			2070 PLANNING DECADE		
	2016 RWP	2021 RWP	DIFFERENCE (%)	2016 RWP	2021 RWP	DIFFERENCE (%)
HUDSPETH COUNTY | MINING WUG TYPE						
EXISTING WUG SUPPLY TOTAL (acre-feet per year)	481	283	-41.2%	481	283	-41.2%
PROJECTED DEMAND TOTAL (acre-feet per year)	479	479	0.0%	502	502	0.0%
WATER SUPPLY NEEDS TOTAL (acre-feet per year)*	0	196	100.0%	21	219	942.9%
HUDSPETH COUNTY | MUNICIPAL WUG TYPE						
EXISTING WUG SUPPLY TOTAL (acre-feet per year)	842	1,016	20.7%	842	1,016	20.7%
PROJECTED DEMAND TOTAL (acre-feet per year)	151	284	88.1%	169	311	84.0%
WATER SUPPLY NEEDS TOTAL (acre-feet per year)*	0	0	0.0%	0	0	0.0%
JEFF DAVIS COUNTY | COUNTY-OTHER WUG TYPE						
EXISTING WUG SUPPLY TOTAL (acre-feet per year)	672	344	-48.8%	672	344	-48.8%
PROJECTED DEMAND TOTAL (acre-feet per year)	168	153	-8.9%	155	142	-8.4%
WATER SUPPLY NEEDS TOTAL (acre-feet per year)*	0	0	0.0%	0	0	0.0%
JEFF DAVIS COUNTY | IRRIGATION WUG TYPE						
EXISTING WUG SUPPLY TOTAL (acre-feet per year)	3,357	1,366	-59.3%	3,357	1,366	-59.3%
PROJECTED DEMAND TOTAL (acre-feet per year)	2,560	665	-74.0%	2,490	665	-73.3%
WATER SUPPLY NEEDS TOTAL (acre-feet per year)*	0	0	0.0%	0	0	0.0%
JEFF DAVIS COUNTY | LIVESTOCK WUG TYPE						
EXISTING WUG SUPPLY TOTAL (acre-feet per year)	495	470	-5.1%	495	470	-5.1%
PROJECTED DEMAND TOTAL (acre-feet per year)	495	397	-19.8%	495	397	-19.8%
WATER SUPPLY NEEDS TOTAL (acre-feet per year)*	0	0	0.0%	0	0	0.0%
JEFF DAVIS COUNTY | MINING WUG TYPE						
EXISTING WUG SUPPLY TOTAL (acre-feet per year)	0	153	100.0%	0	153	100.0%
PROJECTED DEMAND TOTAL (acre-feet per year)	0	153	100.0%	0	153	100.0%
WATER SUPPLY NEEDS TOTAL (acre-feet per year)*	0	0	0.0%	0	0	0.0%
JEFF DAVIS COUNTY | MUNICIPAL WUG TYPE						
EXISTING WUG SUPPLY TOTAL (acre-feet per year)	343	468	36.4%	343	468	36.4%
PROJECTED DEMAND TOTAL (acre-feet per year)	297	319	7.4%	285	307	7.7%
WATER SUPPLY NEEDS TOTAL (acre-feet per year)*	0	0	0.0%	0	0	0.0%
PRESIDIO COUNTY | COUNTY-OTHER WUG TYPE						
EXISTING WUG SUPPLY TOTAL (acre-feet per year)	588	482	-18.0%	588	482	-18.0%
PROJECTED DEMAND TOTAL (acre-feet per year)	249	100	-59.8%	361	166	-54.0%
WATER SUPPLY NEEDS TOTAL (acre-feet per year)*	0	0	0.0%	0	0	0.0%
PRESIDIO COUNTY | IRRIGATION WUG TYPE						
EXISTING WUG SUPPLY TOTAL (acre-feet per year)	9,001	9,001	0.0%	9,001	9,001	0.0%
PROJECTED DEMAND TOTAL (acre-feet per year)	4,630	4,006	-13.5%	4,197	4,006	-4.6%
WATER SUPPLY NEEDS TOTAL (acre-feet per year)*	0	0	0.0%	0	0	0.0%
PRESIDIO COUNTY | LIVESTOCK WUG TYPE						
EXISTING WUG SUPPLY TOTAL (acre-feet per year)	408	366	-10.3%	408	366	-10.3%
PROJECTED DEMAND TOTAL (acre-feet per year)	408	328	-19.6%	408	328	-19.6%
WATER SUPPLY NEEDS TOTAL (acre-feet per year)*	0	0	0.0%	0	0	0.0%
PRESIDIO COUNTY | MINING WUG TYPE						
EXISTING WUG SUPPLY TOTAL (acre-feet per year)	403	403	0.0%	403	403	0.0%
PROJECTED DEMAND TOTAL (acre-feet per year)	403	403	0.0%	0	0	0.0%
WATER SUPPLY NEEDS TOTAL (acre-feet per year)*	0	0	0.0%	0	0	0.0%

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Region E Water User Group (WUG) Data Comparison to 2016 Regional Water Plan (RWP)

	2020 PLANNING DECADE			2070 PLANNING DECADE		
	2016 RWP	2021 RWP	DIFFERENCE (%)	2016 RWP	2021 RWP	DIFFERENCE (%)
PRESIDIO COUNTY | MUNICIPAL WUG TYPE						
EXISTING WUG SUPPLY TOTAL (acre-feet per year)	5,363	5,863	9.3%	5,363	5,863	9.3%
PROJECTED DEMAND TOTAL (acre-feet per year)	1,248	1,428	14.4%	1,659	1,900	14.5%
WATER SUPPLY NEEDS TOTAL (acre-feet per year)*	0	0	0.0%	0	0	0.0%
TERRELL COUNTY | COUNTY-OTHER WUG TYPE						
EXISTING WUG SUPPLY TOTAL (acre-feet per year)	61	75	23.0%	61	75	23.0%
PROJECTED DEMAND TOTAL (acre-feet per year)	19	21	10.5%	19	20	5.3%
WATER SUPPLY NEEDS TOTAL (acre-feet per year)*	0	0	0.0%	0	0	0.0%
TERRELL COUNTY | IRRIGATION WUG TYPE						
EXISTING WUG SUPPLY TOTAL (acre-feet per year)	1,091	914	-16.2%	1,091	914	-16.2%
PROJECTED DEMAND TOTAL (acre-feet per year)	379	751	98.2%	337	751	122.8%
WATER SUPPLY NEEDS TOTAL (acre-feet per year)*	0	0	0.0%	0	0	0.0%
TERRELL COUNTY | LIVESTOCK WUG TYPE						
EXISTING WUG SUPPLY TOTAL (acre-feet per year)	238	206	-13.4%	238	206	-13.4%
PROJECTED DEMAND TOTAL (acre-feet per year)	238	151	-36.6%	238	151	-36.6%
WATER SUPPLY NEEDS TOTAL (acre-feet per year)*	0	0	0.0%	0	0	0.0%
TERRELL COUNTY | MINING WUG TYPE						
EXISTING WUG SUPPLY TOTAL (acre-feet per year)	224	190	-15.2%	224	190	-15.2%
PROJECTED DEMAND TOTAL (acre-feet per year)	673	673	0.0%	385	385	0.0%
WATER SUPPLY NEEDS TOTAL (acre-feet per year)*	449	483	7.6%	161	195	21.1%
TERRELL COUNTY | MUNICIPAL WUG TYPE						
EXISTING WUG SUPPLY TOTAL (acre-feet per year)	527	476	-9.7%	527	476	-9.7%
PROJECTED DEMAND TOTAL (acre-feet per year)	202	178	-11.9%	199	177	-11.1%
WATER SUPPLY NEEDS TOTAL (acre-feet per year)*	0	0	0.0%	0	0	0.0%
REGION E						
EXISTING WUG SUPPLY TOTAL (acre-feet per year)	495,071	480,643	-2.9%	501,766	475,118	-5.3%
PROJECTED DEMAND TOTAL (acre-feet per year)	645,404	480,424	-25.6%	693,597	559,976	-19.3%
WATER SUPPLY NEEDS TOTAL (acre-feet per year)*	188,867	60,629	-67.9%	212,046	118,844	-44.0%

*WUG supplies and projected demands are entered for each of a WUG's region-county-basin divisions. The needs shown in the WUG Data Comparison to 2016 RWP report are calculated by first deducting the WUG split's projected demand from its total existing water supply volume. If the WUG split has a greater existing supply volume than projected demand in any given decade, this amount is considered a surplus volume. Before aggregating the difference between supplies and demands to the WUG county and category level, calculated surpluses are updated to zero so that only the WUGs with needs in the decade are included with the Needs totals.

Region E Source Data Comparison to 2016 Regional Water Plan (RWP)

	2020 PLANNING DECADE			2070 PLANNING DECADE		
	2016 RWP	2021 RWP	DIFFERENCE (%)	2016 RWP	2021 RWP	DIFFERENCE (%)
BREWSTER COUNTY						
GROUNDWATER AVAILABILITY TOTAL (acre-feet per year)	16,207	13,786	-14.9%	16,202	13,782	-14.9%
SURFACE WATER AVAILABILITY TOTAL (acre-feet per year)	8,101	7,774	-4.0%	8,101	7,774	-4.0%
CULBERSON COUNTY						
GROUNDWATER AVAILABILITY TOTAL (acre-feet per year)	63,433	60,731	-4.3%	63,193	60,391	-4.4%
EL PASO COUNTY						
GROUNDWATER AVAILABILITY TOTAL (acre-feet per year)	610,380	492,922	-19.2%	610,380	492,922	-19.2%
REUSE AVAILABILITY TOTAL (acre-feet per year)	37,002	53,917	45.7%	47,102	60,005	27.4%
SURFACE WATER AVAILABILITY TOTAL (acre-feet per year)	69,683	46,605	-33.1%	69,683	46,605	-33.1%
HUDSPETH COUNTY						
GROUNDWATER AVAILABILITY TOTAL (acre-feet per year)	168,761	238,984	41.6%	168,761	238,984	41.6%
REUSE AVAILABILITY TOTAL (acre-feet per year)	334	334	0.0%	334	334	0.0%
SURFACE WATER AVAILABILITY TOTAL (acre-feet per year)	1,471	725	-50.7%	1,471	725	-50.7%
JEFF DAVIS COUNTY						
GROUNDWATER AVAILABILITY TOTAL (acre-feet per year)	20,509	11,095	-45.9%	20,396	10,932	-46.4%
PRESIDIO COUNTY						
GROUNDWATER AVAILABILITY TOTAL (acre-feet per year)	20,540	20,919	1.8%	20,067	20,242	0.9%
SURFACE WATER AVAILABILITY TOTAL (acre-feet per year)	10,894	10,218	-6.2%	10,894	10,218	-6.2%
TERRELL COUNTY						
GROUNDWATER AVAILABILITY TOTAL (acre-feet per year)	1,421	1,420	-0.1%	1,421	1,420	-0.1%
SURFACE WATER AVAILABILITY TOTAL (acre-feet per year)	720	441	-38.8%	720	441	-38.8%
REGION E						
GROUNDWATER AVAILABILITY TOTAL (acre-feet per year)	901,251	839,857	-6.8%	900,420	838,673	-6.9%
REUSE AVAILABILITY TOTAL (acre-feet per year)	37,336	54,251	45.3%	47,436	60,339	27.2%
SURFACE WATER AVAILABILITY TOTAL (acre-feet per year)	90,869	65,763	-27.6%	90,869	65,763	-27.6%

* Since reservoir sources can exist across multiple counties, the county field value, ‘reservoir’ is applied to all reservoir sources.

Region E Water User Group (WUG) Unmet Needs

WUG supplies and projected demands are entered for each of a WUG's region-county-basin divisions. The unmet needs shown in the WUG Unmet Needs report are calculated by first deducting the WUG split's projected demand from the sum of its total existing water supply volume and all associated recommended water management strategy water volumes. If the WUG split has a greater future supply volume than projected demand in any given decade, this amount is considered a surplus volume. In order to display only unmet needs associated with the WUG split, these surplus volumes are updated to a zero and the unmet needs water volumes are shown as absolute values.

	WUG UNMET NEEDS (ACRE-FEET PER YEAR)					
	2020	2030	2040	2050	2060	2070
CULBERSON COUNTY - RIO GRANDE BASIN						
IRRIGATION	0	0	5,418	5,418	5,418	5,418
EL PASO COUNTY - RIO GRANDE BASIN						
MINING	0	0	0	0	285	1,131
IRRIGATION	12,941	9,691	9,691	9,691	9,691	9,691
TERRELL COUNTY - RIO GRANDE BASIN						
MINING	483	586	550	416	293	195

*A single asterisk next to a WUG's name denotes that the WUG is split by two or more planning regions.

Region E Water User Group (WUG) Unmet Needs Summary

WUG supplies and projected demands are entered for each of a WUG's region-county-basin divisions. The unmet needs shown in the WUG Unmet Needs Summary report are calculated by first deducting the WUG split's projected demand from the sum of its total existing water supply volume and all associated recommended water management strategy water volumes. If the WUG split has a greater future supply volume than projected demand in any given decade, this amount is considered a surplus volume. Before aggregating the difference between supplies and demands to the WUG category level, calculated surpluses are updated to zero so that only the WUGs with unmet needs in the decade are included with the Needs totals. Unmet needs water volumes are shown as absolute values.

WUG CATEGORY	NEEDS (ACRE-FEET PER YEAR)					
	2020	2030	2040	2050	2060	2070
MUNICIPAL	0	0	0	0	0	0
COUNTY-OTHER	0	0	0	0	0	0
MANUFACTURING	0	0	0	0	0	0
MINING	483	586	550	416	578	1,326
STEAM ELECTRIC POWER	0	0	0	0	0	0
LIVESTOCK	0	0	0	0	0	0
IRRIGATION	12,941	9,691	15,109	15,109	15,109	15,109

Region E Recommended Water User Group (WUG) Water Management Strategies (WMS)

						WATER MANAGEMENT STRATEGY SUPPLY (ACRE-FEET PER YEAR)					
WUG ENTITY NAME	WMS SPONSOR REGION	WMS NAME	SOURCE NAME	UNIT COST 2020	UNIT COST 2070	2020	2030	2040	2050	2060	2070
ALPINE	E	CITY OF ALPINE - IRRIGATION AND RECHARGE APPLICATION OF CAPTURED RAINWATER RUNOFF	E | RAINWATER HARVESTING	N/A	$307	0	70	70	70	70	70
ALPINE	E	CITY OF ALPINE - MODIFICATION TO WASTEWATER TREATMENT FACILITY & IRRIGATION SYSTEM	E | DIRECT NON-POTABLE REUSE	N/A	$2400	0	25	25	25	25	25
ANTHONY	E	TOWN OF ANTHONY - ADDITIONAL GROUNDWATER WELL	E | HUECO-MESILLA BOLSON AQUIFER FRESH/BRACKISH | EL PASO COUNTY	$200	$65	960	960	960	960	960	960
ANTHONY	E	TOWN OF ANTHONY - ARSENIC TREATMENT FACILITY	E | HUECO-MESILLA BOLSON AQUIFER FRESH/BRACKISH | EL PASO COUNTY	$562	$302	2,800	2,800	2,800	2,800	2,800	2,800
COUNTY-OTHER, BREWSTER	E	BREWSTER COUNTY OTHER - STUDY BUTTE TERLINGUA WS - WATER LOSS AUDIT AND MAIN-LINE REPAIR	DEMAND REDUCTION	$8600	$8600	25	25	25	25	25	25
COUNTY-OTHER, BREWSTER	E	MARATHON WSSSERVICE - WATER LOSS AUDIT AND MAIN-LINE REPAIR	DEMAND REDUCTION	$1500	$1500	12	12	12	12	12	12
COUNTY-OTHER, EL PASO	E	EL PASO COUNTY OTHER - (VINTON HILLS) - PURCHASE WATER FROM EPW	E | HUECO-MESILLA BOLSON AQUIFER FRESH/BRACKISH | EL PASO COUNTY	N/A	$1041	0	0	0	10	73	133
COUNTY-OTHER, EL PASO	E	EL PASO COUNTY-OTHER - (VINTON HILLS) - PUBLIC CONSERVATION EDUCATION	DEMAND REDUCTION	N/A	$404	0	0	0	4	5	5
COUNTY-OTHER, HUDSPETH	E	HUDSPETH COUNTY OTHER - HUDSPETH CO. WCID #1 - GROUNDWATER WELL NE OF VAN HORN	E | WEST TEXAS BOLSONS AQUIFER FRESH/BRACKISH | CULBERSON COUNTY	$4385	N/A	39	39	39	39	39	0
COUNTY-OTHER, HUDSPETH	E	HUDSPETH COUNTY OTHER - HUDSPETH CO. WCID #1 - GROUNDWATER WELL WEST OF VAN HORN	E | OTHER AQUIFER | HUDSPETH COUNTY	$1333	$179	39	39	39	39	39	39
COUNTY-OTHER, HUDSPETH	E	HUDSPETH COUNTY OTHER - HUDSPETH CO. WCID #1 - LOCAL GROUNDWATER WELL	E | OTHER AQUIFER | HUDSPETH COUNTY	$8375	$4375	16	16	16	16	16	16
COUNTY-OTHER, HUDSPETH	E	HUDSPETH COUNTY OTHER - HUDSPETH CO. WCID #1 - PUBLIC CONSERVATION EDUCATION	DEMAND REDUCTION	$402	$371	1	2	2	2	2	2
COUNTY-OTHER, HUDSPETH	E	HUDSPETH COUNTY OTHER - HUDSPETH CO. WCID #1 - REPLACE WATER SUPPLY LINE FROM VAN HORN	E | WEST TEXAS BOLSONS AQUIFER FRESH/BRACKISH | CULBERSON COUNTY	N/A	N/A	0	39	39	39	28	0
COUNTY-OTHER, HUDSPETH	E	HUDSPETH COUNTY OTHER (DELL CITY) - BRACKISH GROUNDWATER DESALINATION FACILITY	E | BONE SPRING-VICTORIO PEAK AQUIFER FRESH/BRACKISH | HUDSPETH COUNTY	N/A	$1928	0	111	111	111	111	111
COUNTY-OTHER, JEFF DAVIS	E	JEFF DAVIS COUNTY OTHER (TOWN OF VALENTINE) - ADDITIONAL GROUNDWATER WELL	E | WEST TEXAS BOLSONS AQUIFER FRESH/BRACKISH | JEFF DAVIS COUNTY	$574	$147	129	129	129	129	129	129

*A single asterisk next to a WUG's name denotes that the WUG is split by two or more planning regions.

Region E Recommended Water User Group (WUG) Water Management Strategies (WMS)

						WATER MANAGEMENT STRATEGY SUPPLY (ACRE-FEET PER YEAR)					
WUG ENTITY NAME	WMS SPONSOR REGION	WMS NAME	SOURCE NAME	UNIT COST 2020	UNIT COST 2070	2020	2030	2040	2050	2060	2070
EAST MONTANA WATER SYSTEM	E	EAST MONTANA WS - WATER LOSS AUDIT AND MAIN-LINE REPAIR	DEMAND REDUCTION	$1756	$1143	41	46	50	54	59	63
EL PASO COUNTY TORNILLO WID	E	EL PASO CO. TORNILLO WID - ADDITIONAL GROUNDWATER WELL AND TRANSMISSION LINE	E | HUECO-MESILLA BOLSON AQUIFER FRESH/BRACKISH | EL PASO COUNTY	$676	$240	333	333	333	333	333	333
EL PASO WATER	E	EPW - ADVANCED WATER PURIFICATION AT THE BUSTAMANTE WWTP	E | DIRECT NON-POTABLE REUSE	$1255	$474	8,500	9,200	9,900	10,600	10,600	10,600
EL PASO WATER	E	EPW - GROUNDWATER FROM DELL CITY AREA (PHASE 1)	E | CAPITAN REEF COMPLEX AQUIFER FRESH/BRACKISH | CULBERSON COUNTY	N/A	$692	0	0	5,525	5,525	5,525	5,525
EL PASO WATER	E	EPW - GROUNDWATER FROM DELL CITY AREA (PHASE 1)	E | CAPITAN REEF COMPLEX AQUIFER FRESH/BRACKISH | HUDSPETH COUNTY	N/A	$692	0	0	4,475	4,475	4,475	4,475
EL PASO WATER	E	EPW - GROUNDWATER FROM DELL CITY AREA (PHASE 2)	E | BONE SPRING-VICTORIO PEAK AQUIFER FRESH/BRACKISH | HUDSPETH COUNTY	N/A	$1548	0	0	0	10,000	10,000	10,000
EL PASO WATER	E	EPW - HUECO BOLSON ARTIFICIAL RECHARGE	E | HUECO-MESILLA BOLSON AQUIFER FRESH/BRACKISH | EL PASO COUNTY	N/A	$251	0	5,000	5,000	5,000	5,000	5,000
EL PASO WATER	E	EPW - MUNICIPAL CONSERVATION PROGRAM	DEMAND REDUCTION	$216	$60	4,950	5,530	5,080	9,940	13,140	17,820
FORT DAVIS WSC	E	FORT DAVIS WSC - ADDITIONAL GROUNDWATER WELL	E | IGNEOUS AQUIFER | JEFF DAVIS COUNTY	$285	$135	274	274	274	274	274	274
FORT DAVIS WSC	E	FORT DAVIS WSC - TRANSMISSION LINE TO CONNECT FORT DAVIS WSC TO FORT DAVIS ESTATES	E | IGNEOUS AQUIFER | JEFF DAVIS COUNTY	N/A	$228	0	114	114	114	114	114
HACIENDAS DEL NORTE WID	E	HACIENDAS DEL NORTE WID - WATER LOSS AUDIT AND MAIN-LINE REPAIR	DEMAND REDUCTION	$4500	$2842	12	13	15	16	17	19
HORIZON REGIONAL MUD	E	HORIZON REGIONAL MUD - ADDITIONAL WELLS AND EXPANSION OF DESALINATION PLANT	E | HUECO-MESILLA BOLSON AQUIFER FRESH/BRACKISH | EL PASO COUNTY	$895	$594	7,460	7,460	7,460	7,460	7,460	7,460
HORIZON REGIONAL MUD	E	HORIZON REGIONAL MUD - ADDITIONAL WELLS AND EXPANSION OF DESALINATION PLANT	E | OTHER AQUIFER BRACKISH | EL PASO COUNTY	$895	$594	9,326	9,326	9,326	9,326	9,326	9,326
HORIZON REGIONAL MUD	E	HORIZON REGIONAL MUD - PUBLIC CONSERVATION EDUCATION	DEMAND REDUCTION	$248	$99	79	110	140	169	196	222
HORIZON REGIONAL MUD	E	HORIZON REGIONAL MUD - WATER LOSS AUDIT AND MAIN-LINE REPAIR	DEMAND REDUCTION	$91	$33	197	274	346	418	487	551
IRRIGATION, CULBERSON	E	CULBERSON COUNTY IRRIGATION - ADDITIONAL WELL IN THE WEST TEXAS BOLSONS AQUIFER	E | WEST TEXAS BOLSONS AQUIFER BRACKISH | CULBERSON COUNTY	$162	$54	333	333	333	333	333	333
IRRIGATION, CULBERSON	E	CULBERSON COUNTY IRRIGATION - IRRIGATION SCHEDULING	DEMAND REDUCTION	$0	$0	107	107	107	107	107	107
IRRIGATION, EL PASO	E	EPCWID #1 - IMPROVEMENTS TO WATER DISTRICT DELIVERY SYSTEM	DEMAND REDUCTION	$9	$9	25,000	25,000	25,000	25,000	25,000	25,000

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Region E Recommended Water User Group (WUG) Water Management Strategies (WMS)

						WATER MANAGEMENT STRATEGY SUPPLY (ACRE-FEET PER YEAR)					
WUG ENTITY NAME	WMS SPONSOR REGION	WMS NAME	SOURCE NAME	UNIT COST 2020	UNIT COST 2070	2020	2030	2040	2050	2060	2070
IRRIGATION, EL PASO	E	EPCWID #1 - IRRIGATION SCHEDULING	DEMAND REDUCTION	$59	$59	1,740	1,740	1,740	1,740	1,740	1,740
IRRIGATION, EL PASO	E	EPCWID #1 - NEW WASTEWAY 32 RIVER DIVERSION PUMPING PLANT	E | RIO GRANDE RUN-OF-RIVER	$18	$3	5,000	5,000	5,000	5,000	5,000	5,000
IRRIGATION, EL PASO	E	EPCWID #1 - RIVERSIDE REGULATING RESERVOIR	E | REGULATING LAKE/RESERVOIR	N/A	$51	0	3,250	3,250	3,250	3,250	3,250
IRRIGATION, EL PASO	E	EPCWID #1 - TAILWATER REUSE	DEMAND REDUCTION	$565	$565	1,723	1,723	1,723	1,723	1,723	1,723
LAJITAS MUNICIPAL SERVICES	E	LAJITAS MUNICIPAL SERVICES - WATER LOSS AUDIT AND MAIN-LINE REPAIR	DEMAND REDUCTION	$3510	$3510	51	51	51	51	51	51
LOWER VALLEY WATER DISTRICT	E	LVWD - GROUNDWATER FROM PROPOSED WELL FIELD - HUECO BOLSON AQUIFER	E | HUECO-MESILLA BOLSON AQUIFER FRESH/BRACKISH | EL PASO COUNTY	N/A	$1096	0	6,800	6,800	6,800	6,800	6,800
LOWER VALLEY WATER DISTRICT	E	LVWD - GROUNDWATER FROM PROPOSED WELL FIELD - RIO GRANDE ALLUVIUM AQUIFER	E | OTHER AQUIFER BRACKISH | EL PASO COUNTY	N/A	$1099	0	6,800	6,800	6,800	6,800	6,800
LOWER VALLEY WATER DISTRICT	E	LVWD - PUBLIC CONSERVATION EDUCATION	DEMAND REDUCTION	$5950	$570	57	66	74	83	92	100
LOWER VALLEY WATER DISTRICT	E	LVWD - PURCHASE WATER FROM EPW	E | HUECO-MESILLA BOLSON AQUIFER FRESH/BRACKISH | EL PASO COUNTY	$436	$436	1,344	2,185	3,012	3,895	4,785	5,632
LOWER VALLEY WATER DISTRICT	E	LVWD - SURFACE WATER TREATMENT PLANT AND TRANSMISSION LINE	E | RIO GRANDE RUN-OF-RIVER	N/A	$445	0	5,000	5,000	5,000	5,000	5,000
LOWER VALLEY WATER DISTRICT	E	LVWD - WASTEWATER TREATMENT FACILITY AND ASR	E | HUECO-MESILLA BOLSON AQUIFER ASR FRESH/BRACKISH | EL PASO COUNTY	N/A	$212	0	5,589	5,589	5,589	5,589	5,589
MANUFACTURING, EL PASO	E	EL PASO COUNTY (MANUFACTURING) - PURCHASE WATER FROM EPW	E | HUECO-MESILLA BOLSON AQUIFER FRESH/BRACKISH | EL PASO COUNTY	N/A	$1168	0	860	860	860	860	860
MINING, EL PASO	E	EL PASO CO. (MINING) - ADDITIONAL GROUNDWATER WELLS	E | HUECO-MESILLA BOLSON AQUIFER FRESH/BRACKISH | EL PASO COUNTY	$41	$21	4,251	4,251	4,251	4,251	4,251	4,251
MINING, HUDSPETH	E	HUDSPETH COUNTY MINING - ADDITIONAL GROUNDWATER WELL	E | WEST TEXAS BOLSONS AQUIFER BRACKISH | HUDSPETH COUNTY	$146	$46	219	219	219	219	219	219
PRESIDIO	E	CITY OF PRESIDIO - ADDITIONAL GROUNDWATER WELL IN THE WEST TEXAS BOLSONS AQUIFER	E | WEST TEXAS BOLSONS AQUIFER FRESH/BRACKISH | PRESIDIO COUNTY	$1558	$86	120	120	120	120	120	120
PRESIDIO	E	CITY OF PRESIDIO - WATER LOSS AUDIT AND MAIN-LINE REPAIR	DEMAND REDUCTION	$1029	$800	35	37	38	41	43	45
STEAM ELECTRIC POWER, EL PASO	E	EL PASO COUNTY (SEP) - PURCHASE WATER FROM EPW	E | HUECO-MESILLA BOLSON AQUIFER FRESH/BRACKISH | EL PASO COUNTY	$475	$475	7,260	7,260	7,260	7,260	7,260	7,260

REGION E RECOMMENDED WMS SUPPLY TOTAL	82,433	118,338	129,532	146,107	150,363	155,989

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Region E Recommended Water User Group (WUG) Water Management Strategies (WMS)

*A single asterisk next to a WUG's name denotes that the WUG is split by two or more planning regions.

Region E Recommended Projects Associated with Water Management Strategies

SPONSOR NAME	SPONSOR IS WWP?	ONLINE DECADE	PROJECT NAME	PROJECT DESCRIPTION	CAPITAL COST
ALPINE	NO	2030	CITY OF ALPINE - IRRIGATION APPLICATION OF CAPTURED RAINWATER RUNOFF	CONSERVATION - MUNICIPAL (DOES NOT INCLUDE METER REPLACEMENT OR WATER LOSS); RAINWATER HARVESTING SYSTEM	$1,296,000
ALPINE	NO	2030	CITY OF ALPINE - MODIFICATION TO WASTEWATER TREATMENT FACILITY & IRRIGATION SYSTEM	STORAGE TANK; CONVEYANCE/TRANSMISSION PIPELINE	$2,318,000
ANTHONY	NO	2020	TOWN OF ANTHONY - ADDITIONAL GROUNDWATER WELL	CONVEYANCE/TRANSMISSION PIPELINE; NEW AGREEMENT; SINGLE WELL	$1,913,000
ANTHONY	NO	2020	TOWN OF ANTHONY - ARSENIC TREATMENT FACILITY	CONVEYANCE/TRANSMISSION PIPELINE; NEW WATER TREATMENT PLANT; STORAGE TANK	$10,334,000
COUNTY-OTHER, BREWSTER	NO	2020	BREWSTER COUNTY OTHER (MARATHON WSSSERVICE) - WATER LOSS AUDIT AND MAIN-LINE REPAIR	CONVEYANCE/TRANSMISSION PIPELINE; WATER LOSS CONTROL	$255,000
COUNTY-OTHER, BREWSTER	NO	2020	BREWSTER COUNTY OTHER (STUDY BUTTE TERLINGUA WS) - WATER LOSS AUDIT AND MAIN-LINE REPAIR	WATER LOSS CONTROL	$3,054,000
COUNTY-OTHER, HUDSPETH	NO	2020	HUDSPETH COUNTY OTHER - HUDSPETH CO. WCID #1 - GROUNDWATER WELL NE OF VAN HORN	SINGLE WELL; CONVEYANCE/TRANSMISSION PIPELINE	$2,132,000
COUNTY-OTHER, HUDSPETH	NO	2020	HUDSPETH COUNTY OTHER - HUDSPETH CO. WCID #1 - GROUNDWATER WELL WEST OF VAN HORN	CONVEYANCE/TRANSMISSION PIPELINE; SINGLE WELL	$636,000
COUNTY-OTHER, HUDSPETH	NO	2020	HUDSPETH COUNTY OTHER - HUDSPETH CO. WCID #1 - LOCAL GROUNDWATER WELL	SINGLE WELL; CONVEYANCE/TRANSMISSION PIPELINE	$940,000
COUNTY-OTHER, HUDSPETH	NO	2030	HUDSPETH COUNTY OTHER (CITY OF SIERRA BLANCA - HUDSPETH CO. WCID #1) - REPLACE WATER SUPPLY LINE	CONVEYANCE/TRANSMISSION PIPELINE	$18,432,000
COUNTY-OTHER, HUDSPETH	NO	2030	HUDSPETH COUNTY OTHER (DELL CITY) - BRACKISH GROUNDWATER DESALINATION FACILITY	NEW WATER TREATMENT PLANT	$1,636,000
COUNTY-OTHER, JEFF DAVIS	NO	2020	JEFF DAVIS COUNTY OTHER (TOWN OF VALENTINE) - ADDITIONAL GROUNDWATER WELL	CONVEYANCE/TRANSMISSION PIPELINE; SINGLE WELL	$783,000
EAST MONTANA WATER SYSTEM	NO	2020	EAST MONTANA WS - WATER LOSS AUDIT AND MAIN-LINE REPAIR	WATER LOSS CONTROL	$1,018,000
EL PASO COUNTY TORNILLO WID	NO	2020	EL PASO CO. TORNILLO WID - ADDITIONAL GROUNDWATER WELL AND TRANSMISSION LINE	CONVEYANCE/TRANSMISSION PIPELINE; NEW WATER TREATMENT PLANT; PUMP STATION; SINGLE WELL; STORAGE TANK	$2,060,000
EL PASO WATER	YES	2020	EPW - ADVANCED PURIFIED WATER AT THE BUSTAMANTE WWTP	CONVEYANCE/TRANSMISSION PIPELINE; INJECTION WELL; WATER TREATMENT PLANT EXPANSION; PUMP STATION	$100,361,400
EL PASO WATER	YES	2040	EPW - GROUNDWATER FROM DELL CITY AREA (PHASE 1)	CONVEYANCE/TRANSMISSION PIPELINE; MULTIPLE WELLS/WELL FIELD; NEW WATER TREATMENT PLANT; PUMP STATION; STORAGE TANK	$569,357,000
EL PASO WATER	YES	2050	EPW - GROUNDWATER FROM DELL CITY AREA (PHASE 2)	CONVEYANCE/TRANSMISSION PIPELINE; MULTIPLE WELLS/WELL FIELD; NEW WATER TREATMENT PLANT; PUMP STATION; STORAGE TANK	$320,226,000
EL PASO WATER	YES	2030	EPW - HUECO BOLSON ARTIFICIAL RECHARGE	CONVEYANCE/TRANSMISSION PIPELINE; DIVERSION AND CONTROL STRUCTURE	$38,003,000
EL PASO WATER	YES	2020	EPW - MUNICIPAL CONSERVATION PROGRAM	CONSERVATION - MUNICIPAL (DOES NOT INCLUDE METER REPLACEMENT OR WATER LOSS); WATER LOSS CONTROL	$1,071,000
FORT DAVIS WSC	NO	2020	FORT DAVIS WSC - ADDITIONAL GROUNDWATER WELL	CONVEYANCE/TRANSMISSION PIPELINE; SINGLE WELL	$584,000
FORT DAVIS WSC	NO	2030	FORT DAVIS WSC - ADDITIONAL TRANSMISSION LINE	CONVEYANCE/TRANSMISSION PIPELINE	$1,671,000
HACIENDAS DEL NORTE WID	NO	2020	HACIENDAS DEL NORTE WID - WATER LOSS AUDIT AND MAIN-LINE REPAIR	WATER LOSS CONTROL	$764,000
HORIZON REGIONAL MUD	NO	2020	HORIZON REGIONAL MUD - ADDITIONAL WELLS AND EXPANSION OF DESAL PLANT	CONVEYANCE/TRANSMISSION PIPELINE; MULTIPLE WELLS/WELL FIELD; WATER TREATMENT PLANT EXPANSION	$71,809,000
HORIZON REGIONAL MUD	NO	2020	HORIZON REGIONAL MUD - WATER LOSS AUDIT AND MAIN-LINE REPAIR	WATER LOSS CONTROL	$255,000
IRRIGATION, CULBERSON	NO	2020	CULBERSON COUNTY IRRIGATION - ADDITIONAL GROUNDWATER WELL - WEST TEXAS BOLSONS AQUIFER	SINGLE WELL	$510,000
IRRIGATION, EL PASO	NO	2020	EL PASO COUNTY - EPCWID #1 - IMPROVEMENTS TO WATER DISTRICT DELIVERY SYSTEM	CANAL LINING; CONVEYANCE/TRANSMISSION PIPELINE; DIVERSION AND CONTROL STRUCTURE	$157,777,783
IRRIGATION, EL PASO	NO	2020	EL PASO COUNTY - EPCWID #1 - IRRIGATION SCHEDULING	CONSERVATION - AGRICULTURAL	$102,595
IRRIGATION, EL PASO	NO	2030	EL PASO COUNTY - EPCWID #1 - REGULATING RIVERSIDE RESERVOIR	DIVERSION AND CONTROL STRUCTURE	$6,754,036
IRRIGATION, EL PASO	NO	2020	EL PASO COUNTY - EPCWID #1 - TAILWATER REUSE	CONSERVATION - AGRICULTURAL	$973,368

Region E Recommended Projects Associated with Water Management Strategies

SPONSOR NAME	SPONSOR IS WWP?	ONLINE DECADE	PROJECT NAME	PROJECT DESCRIPTION	CAPITAL COST
IRRIGATION, EL PASO	NO	2020	EL PASO COUNTY - EPCWID#1 - NEW WATERWAY 32 RIVER DIVERSION PUMPING POINT	CANAL LINING	$4,055,887
LAJITAS MUNICIPAL SERVICES	NO	2020	LAJITAS MUNICIPAL SERVICES - WATER LOSS AND MAIN-LINE REPAIR	WATER LOSS CONTROL	$2,545,000
LOWER VALLEY WATER DISTRICT	NO	2030	LVWD - GROUNDWATER FROM PROPOSED WELL FIELD - HUECO BOLSON AQUIFER	CONVEYANCE/TRANSMISSION PIPELINE; INJECTION WELL; MULTIPLE WELLS/WELL FIELD; NEW WATER TREATMENT PLANT; PUMP STATION; STORAGE TANK	$36,110,000
LOWER VALLEY WATER DISTRICT	NO	2030	LVWD - GROUNDWATER FROM PROPOSED WELL FIELD - RIO GRANDE ALLUVIUM AQUIFER	CONVEYANCE/TRANSMISSION PIPELINE; INJECTION WELL; MULTIPLE WELLS/WELL FIELD; NEW WATER TREATMENT PLANT; PUMP STATION; STORAGE TANK	$39,236,000
LOWER VALLEY WATER DISTRICT	NO	2030	LVWD - SURFACE WATER TREATMENT PLANT AND TRANSMISSION LINES	CONVEYANCE/TRANSMISSION PIPELINE; NEW AGREEMENT; NEW SURFACE WATER INTAKE; NEW WATER TREATMENT PLANT; PUMP STATION	$74,338,000
LOWER VALLEY WATER DISTRICT	NO	2030	LVWD - WASTEWATER TREATMENT AND ASR FACILITY	CONVEYANCE/TRANSMISSION PIPELINE; INJECTION WELL; NEW WATER TREATMENT PLANT	$23,509,000
MINING, EL PASO	NO	2020	EL PASO COUNTY - MINING - ADDITIONAL GROUNDWATER WELLS	MULTIPLE WELLS/WELL FIELD	$1,208,000
MINING, HUDSPETH	NO	2020	HUDSPETH MINING - ADDITIONAL GROUNDWATER WELL	SINGLE WELL	$306,000
PRESIDIO	NO	2020	CITY OF PRESIDIO - ADDITIONAL GROUNDWATER WELL	CONVEYANCE/TRANSMISSION PIPELINE; NEW WATER TREATMENT PLANT; PUMP STATION; SINGLE WELL; STORAGE TANK	$5,509,000
PRESIDIO	NO	2020	CITY OF PRESIDIO - WATER LOSS AUDIT AND MAIN-LINE REPAIR	CONVEYANCE/TRANSMISSION PIPELINE; WATER LOSS CONTROL	$509,000

REGION E RECOMMENDED CAPITAL COST TOTAL	**$1,504,352,069**

Region E Alternative Water User Group (WUG) Water Management Strategies (WMS)

						WATER MANAGEMENT STRATEGY SUPPLY (ACRE-FEET PER YEAR)					
WUG ENTITY NAME	WMS SPONSOR REGION	WMS NAME	SOURCE NAME	UNIT COST 2020	UNIT COST 2070	2020	2030	2040	2050	2060	2070
EL PASO WATER	E	EPW - ADVANCED WATER PURIFICATION AT THE FRED HERVEY WRP	E | DIRECT NON-POTABLE REUSE	N/A	$808	0	0	10,000	10,000	10,000	10,000
EL PASO WATER	E	EPW - ADVANCED WATER PURIFICATION AT THE HASKELL STREET WRP	E | DIRECT NON-POTABLE REUSE	N/A	$2948	0	0	0	0	0	10,000
EL PASO WATER	E	EPW - EXPANSION OF CANUTILLO MESILLA BOLSON WELL FIELD	E | HUECO-MESILLA BOLSON AQUIFER FRESH/BRACKISH | EL PASO COUNTY	N/A	$70	0	7,760	11,640	15,520	19,400	23,280
EL PASO WATER	E	EPW - EXPANSION OF JONATHAN ROGERS WTP	E | RIO GRANDE RUN-OF-RIVER	N/A	$425	0	0	6,500	6,500	6,500	6,500
EL PASO WATER	E	EPW - EXPANSION OF THE KAY BAILEY HUTCHISON DESAL PLANT	E | HUECO-MESILLA BOLSON AQUIFER FRESH/BRACKISH | EL PASO COUNTY	N/A	$888	0	0	0	0	5,000	5,000
EL PASO WATER	E	EPW - LOWER VALLEY WELLHEAD RO DESAL	E | OTHER AQUIFER BRACKISH | EL PASO COUNTY	N/A	$658	0	0	5,000	5,000	5,000	5,000
EL PASO WATER	E	EPW - RIVERSIDE REGULATING RESERVOIR	E | REGULATING LAKE/RESERVOIR	N/A	$51	0	0	3,250	3,250	3,250	3,250
EL PASO WATER	E	EPW - TREATMENT AND REUSE OF AGRICULTURAL DRAIN WATER	E | RIO GRANDE INDIRECT REUSE	N/A	$51	0	0	2,700	2,700	2,700	2,700
MINING, TERRELL	E	TERRELL COUNTY MINING - ADDITIONAL GROUNDWATER WELLS	E | EDWARDS-TRINITY-PLATEAU, PECOS VALLEY, AND TRINITY AQUIFERS | TERRELL COUNTY	$166	$28	470	470	470	470	470	470
REGION E ALTERNATIVE WMS SUPPLY TOTAL						470	8,230	39,560	43,440	52,320	66,200

*A single asterisk next to a WUG's name denotes that the WUG is split by two or more planning regions.

Region E Alternative Projects Associated with Water Management Strategies

SPONSOR NAME	SPONSOR IS WWP?	ONLINE DECADE	PROJECT NAME	PROJECT DESCRIPTION	CAPITAL COST
EL PASO WATER	YES	2070	EPW - ADVANCED PURIFIED WATER AT THE HASKELL STREET RWP	CONVEYANCE/TRANSMISSION PIPELINE; INJECTION WELL; PUMP STATION; WATER TREATMENT PLANT EXPANSION	$189,356,000
EL PASO WATER	YES	2040	EPW - ADVANCED WATER PURIFICATION AT THE FRED HERVEY WWTP	CONVEYANCE/TRANSMISSION PIPELINE; INJECTION WELL; PUMP STATION; WATER TREATMENT PLANT EXPANSION	$140,394,000
EL PASO WATER	YES	2030	EPW - CONJUNCTIVE TREATMENT OF GROUNDWATER AND SURFACE WATER AT THE UPPER VALLEY WWTP	WATER TREATMENT PLANT EXPANSION	$72,873,000
EL PASO WATER	YES	2030	EPW - EXPANSION OF CANUTILLO MESILLA BOLSON WELL FIELD	CONVEYANCE/TRANSMISSION PIPELINE; MULTIPLE WELLS/WELL FIELD	$6,444,000
EL PASO WATER	YES	2040	EPW - EXPANSION OF JONATHAN ROGERS WTP	WATER RIGHT/PERMIT LEASE OR PURCHASE; WATER TREATMENT PLANT EXPANSION	$88,679,000
EL PASO WATER	YES	2060	EPW - EXPANSION OF THE KAY BAILEY HUTCHINSON DESAL PLANT	CONVEYANCE/TRANSMISSION PIPELINE; INJECTION WELL; MULTIPLE WELLS/WELL FIELD; STORAGE TANK; WATER TREATMENT PLANT EXPANSION	$26,490,000
EL PASO WATER	YES	2040	EPW - LOWER VALLEY WELL HEAD RO	MULTIPLE WELLS/WELL FIELD; PUMP STATION; STORAGE TANK; CONVEYANCE/TRANSMISSION PIPELINE	$52,681,000
EL PASO WATER	YES	2040	EPW - RIVERSIDE REGULATING RESERVOIR	CANAL LINING; CONVEYANCE/TRANSMISSION PIPELINE; DIVERSION AND CONTROL STRUCTURE; NEW SURFACE WATER INTAKE; PUMP STATION	$6,754,036
EL PASO WATER	YES	2040	EPW - TREATMENT AND REUSE OF AGRICULTURAL DRAIN WATER	NEW CONTRACT; NEW WATER TREATMENT PLANT; STORAGE TANK	$21,466,000
MINING, TERRELL	YES	2020	TERRELL COUNTY MINING - ADDITIONAL GROUNDWATER WELLS	MULTIPLE WELLS/WELL FIELD	$921,000

REGION E ALTERNATIVE CAPITAL COST TOTAL	**$606,058,036**

Region E Alternative Projects Associated with Water Management Strategies

SPONSOR NAME	SPONSOR IS WWP?	ONLINE DECADE	PROJECT NAME	PROJECT DESCRIPTION	CAPITAL COST
EL PASO WATER	YES	2070	EPW - ADVANCED PURIFIED WATER AT THE HASKELL STREET RWP	CONVEYANCE/TRANSMISSION PIPELINE; INJECTION WELL; PUMP STATION; WATER TREATMENT PLANT EXPANSION	$189,356,000
EL PASO WATER	YES	2040	EPW - ADVANCED WATER PURIFICATION AT THE FRED HERVEY WWTP	CONVEYANCE/TRANSMISSION PIPELINE; INJECTION WELL; PUMP STATION; WATER TREATMENT PLANT EXPANSION	$140,394,000
EL PASO WATER	YES	2030	EPW - CONJUNCTIVE TREATMENT OF GROUNDWATER AND SURFACE WATER AT THE UPPER VALLEY WWTP	WATER TREATMENT PLANT EXPANSION	$72,873,000
EL PASO WATER	YES	2030	EPW - EXPANSION OF CANUTILLO MESILLA BOLSON WELL FIELD	CONVEYANCE/TRANSMISSION PIPELINE; MULTIPLE WELLS/WELL FIELD	$6,444,000
EL PASO WATER	YES	2040	EPW - EXPANSION OF JONATHAN ROGERS WTP	WATER RIGHT/PERMIT LEASE OR PURCHASE; WATER TREATMENT PLANT EXPANSION	$88,679,000
EL PASO WATER	YES	2060	EPW - EXPANSION OF THE KAY BAILEY HUTCHINSON DESAL PLANT	CONVEYANCE/TRANSMISSION PIPELINE; INJECTION WELL; MULTIPLE WELLS/WELL FIELD; STORAGE TANK; WATER TREATMENT PLANT EXPANSION	$26,490,000
EL PASO WATER	YES	2040	EPW - LOWER VALLEY WELL HEAD RO	MULTIPLE WELLS/WELL FIELD; PUMP STATION; STORAGE TANK; CONVEYANCE/TRANSMISSION PIPELINE	$52,681,000
EL PASO WATER	YES	2040	EPW - RIVERSIDE REGULATING RESERVOIR	CANAL LINING; CONVEYANCE/TRANSMISSION PIPELINE; DIVERSION AND CONTROL STRUCTURE; NEW SURFACE WATER INTAKE; PUMP STATION	$6,754,036
EL PASO WATER	YES	2040	EPW - TREATMENT AND REUSE OF AGRICULTURAL DRAIN WATER	NEW CONTRACT; NEW WATER TREATMENT PLANT; STORAGE TANK	$21,466,000
MINING, TERRELL	YES	2020	TERRELL COUNTY MINING - ADDITIONAL GROUNDWATER WELLS	MULTIPLE WELLS/WELL FIELD	$921,000

REGION E ALTERNATIVE CAPITAL COST TOTAL	**$606,058,036**

Region E Water User Group (WUG) Management Supply Factor

WUG supplies and projected demands are entered for each of a WUG's region-county-basin divisions. To calculate the Management Supply Factor for each WUG as a whole, not split by region-county-basin, the combined total of existing and future supply is divided by the total projected demand. If a WUG is split by more than one planning region, the whole WUG's management supply factor will show up in each of its planning region's management supply factor reports.

	WUG MANAGEMENT SUPPLY FACTOR					
WUG NAME	**2020**	**2030**	**2040**	**2050**	**2060**	**2070**
ALPINE	1.3	1.4	1.4	1.4	1.4	1.4
ANTHONY	6.9	5.8	5.1	4.6	4.1	3.7
COUNTY-OTHER, BREWSTER	1.8	1.7	1.7	1.7	1.6	1.6
COUNTY-OTHER, CULBERSON	2.4	2.3	2.2	2.2	2.1	2.1
COUNTY-OTHER, EL PASO	3.0	2.3	1.8	1.5	1.3	1.2
COUNTY-OTHER, EL PASO | VINTON HILLS ESTATES	1.9	1.4	1.2	1.0	1.0	1.0
COUNTY-OTHER, EL PASO | VINTON HILLS SUBDIVISION	1.9	1.4	1.2	1.0	1.0	1.0
COUNTY-OTHER, HUDSPETH	2.0	4.4	4.4	4.4	4.2	3.1
COUNTY-OTHER, HUDSPETH | DELL CITY	1.4	1.3	1.3	1.3	1.3	1.3
COUNTY-OTHER, HUDSPETH | FORT HANCOCK WCID	2.4	2.3	2.3	2.3	2.3	2.2
COUNTY-OTHER, JEFF DAVIS	2.5	2.6	2.7	2.7	2.7	2.7
COUNTY-OTHER, JEFF DAVIS | CITY OF VALENTINE	5.4	5.6	5.6	5.9	5.9	5.9
COUNTY-OTHER, PRESIDIO	4.8	4.3	3.9	3.5	3.2	2.9
COUNTY-OTHER, TERRELL	3.6	3.6	3.8	3.8	3.8	3.8
EAST BIGGS WATER SYSTEM	1.6	1.6	1.6	1.6	1.6	1.6
EAST MONTANA WATER SYSTEM	1.6	1.4	1.3	1.2	1.1	1.1
EL PASO COUNTY TORNILLO WID	3.6	3.7	3.7	3.8	3.8	3.8
EL PASO COUNTY WCID 4	2.3	2.3	2.4	2.4	2.3	2.3
EL PASO WATER	1.2	1.1	1.1	1.1	1.1	1.0
ESPERANZA WATER SERVICE	3.4	3.2	3.2	3.1	3.1	3.1
FEDERAL CORRECTIONAL INSTITUTION LA TUNA	5.7	5.8	5.9	5.9	5.9	5.9
FORT BLISS WATER SERVICES	1.5	1.5	1.4	1.4	1.3	1.3
FORT DAVIS WSC	2.3	2.7	2.8	2.8	2.8	2.8
HACIENDAS DEL NORTE WID	1.6	1.5	1.3	1.2	1.1	1.1
HORIZON REGIONAL MUD	2.8	2.0	1.6	1.3	1.2	1.0
HUDSPETH COUNTY WCID 1	3.7	3.5	3.5	3.5	3.5	3.4
IRRIGATION, BREWSTER	1.7	1.7	1.7	1.7	1.7	1.7
IRRIGATION, CULBERSON	1.0	1.0	0.9	0.9	0.9	0.9
IRRIGATION, EL PASO	0.9	0.9	0.9	0.9	0.9	0.9
IRRIGATION, HUDSPETH	1.1	1.1	1.1	1.1	1.1	1.1
IRRIGATION, JEFF DAVIS	2.1	2.1	2.1	2.1	2.1	2.1
IRRIGATION, PRESIDIO	2.2	2.2	2.2	2.2	2.2	2.2
IRRIGATION, TERRELL	1.2	1.2	1.2	1.2	1.2	1.2
LAJITAS MUNICIPAL SERVICES	3.7	3.7	3.7	3.7	3.7	3.7
LIVESTOCK, BREWSTER	1.1	1.1	1.1	1.1	1.1	1.1
LIVESTOCK, CULBERSON	1.1	1.1	1.1	1.1	1.1	1.1
LIVESTOCK, EL PASO	1.4	1.4	1.4	1.4	1.4	1.4
LIVESTOCK, HUDSPETH	1.1	1.1	1.1	1.1	1.1	1.1
LIVESTOCK, JEFF DAVIS	1.2	1.2	1.2	1.2	1.2	1.2
LIVESTOCK, PRESIDIO	1.1	1.1	1.1	1.1	1.1	1.1
LIVESTOCK, TERRELL	1.4	1.4	1.4	1.4	1.4	1.4
LOWER VALLEY WATER DISTRICT	1.0	4.7	4.3	3.9	3.6	3.4
MANUFACTURING, CULBERSON	1.2	1.0	1.0	1.0	1.0	1.0
MANUFACTURING, EL PASO	1.0	1.0	1.0	1.0	1.0	1.0

*A single asterisk next to a WUG's name denotes that the WUG is split by more than one planning region.

Region E Water User Group (WUG) Management Supply Factor

	WUG MANAGEMENT SUPPLY FACTOR					
WUG NAME	**2020**	**2030**	**2040**	**2050**	**2060**	**2070**
MARATHON WATER SUPPLY & SEWER SERVICE	2.0	1.9	1.9	1.9	1.9	1.9
MARFA	3.0	2.9	2.7	2.5	2.3	2.2
MINING, CULBERSON	1.9	1.4	1.3	1.5	1.6	1.8
MINING, EL PASO	1.6	1.4	1.2	1.1	1.0	0.8
MINING, HUDSPETH	1.0	1.1	1.1	1.0	1.0	1.0
MINING, JEFF DAVIS	1.0	1.0	1.0	1.0	1.0	1.0
MINING, PRESIDIO	1.0	0.0	0.0	0.0	0.0	0.0
MINING, TERRELL	0.3	0.2	0.3	0.3	0.4	0.5
PASEO DEL ESTE MUD 1	1.5	1.4	1.3	1.2	1.1	1.0
PRESIDIO	5.3	5.1	4.9	4.6	4.3	4.1
STEAM ELECTRIC POWER, EL PASO	1.0	1.0	1.0	1.0	1.0	1.0
TERRELL COUNTY WCID 1	2.7	2.7	2.7	2.7	2.7	2.7
VAN HORN	1.5	1.4	1.4	1.3	1.3	1.3

*A single asterisk next to a WUG's name denotes that the WUG is split by more than one planning region.

Region E Recommended Water Management Strategy (WMS) Supply Associated with a New or Amended Inter-Basin Transfer (IBT) Permit

IBT WMS supply is the portion of the total WMS benefitting WUGs that will require a new or amended IBT permit that is not considered exempt under the Texas Water Code § 11.085.

			IBT WMS SUPPLY (ACRE-FEET PER YEAR)					
WMS NAME	SOURCE BASIN	RECIPIENT WUG BASIN	2020	2030	2040	2050	2060	2070

Region E Water User Groups (WUGs)
Recommended Water Management Strategy (WMS) Supply Associated with a
New or Amended Inter-Basin Transfer (IBT) Permit and Total Recommended Conservation WMS Supply

IBT WMS supply is the portion of the total WMS benefitting the WUG basin split listed that will require a new or amended IBT permit that is not considered exempt under the Texas Water Code § 11.085. Total conservation supply represents all conservation WMS volumes recommended within the WUG's region-basin geographic split.

BENEFITTING WUG NAME | BASIN	WMS SOURCE ORIGIN BASIN | WMS NAME	WMS SUPPLY (ACRE-FEET PER YEAR)					
		2020	2030	2040	2050	2060	2070

Region E Sponsored Recommended Water Management Strategy (WMS) Supplies Unallocated* to Water User Groups (WUG)

WMS NAME	WMS SPONSOR	SOURCE NAME	UNALLOCATED STRATEGY SUPPLY (ACRE-FEET PER YEAR)					
			2020	2030	2040	2050	2060	2070
		TOTAL UNALLOCATED STRATEGY SUPPLIES						

* Strategy supplies created through the WMS that have not been assigned to a WUG will be allocated to the entity responsible for the water through an ‘unassigned water volumes’ entity. Only strategy supplies associated with an 'unassigned water volume' entity are shown in this report, and may not represent all strategy supplies associated with the listed WMS.

Region E Water User Group (WUG) Strategy Supplies by Water Management Strategy (WMS) Type

WMS TYPE *	STRATEGY SUPPLY (ACRE-FEET PER YEAR)					
	2020	2030	2040	2050	2060	2070
AQUIFER STORAGE & RECOVERY	0	5,589	5,589	5,589	5,589	5,589
CONJUNCTIVE USE	0	5,000	5,000	5,000	5,000	5,000
GROUNDWATER DESALINATION	17,005	30,716	30,716	30,716	30,716	30,716
GROUNDWATER WELLS & OTHER	17,898	19,752	30,579	41,472	42,414	43,254
IRRIGATION CONSERVATION	33,570	33,570	33,570	33,570	33,570	33,570
MUNICIPAL CONSERVATION	5,460	6,166	5,833	10,815	14,129	18,915
OTHER DIRECT REUSE	8,500	9,225	9,925	10,625	10,625	10,625
OTHER STRATEGIES	0	70	70	70	70	70
OTHER SURFACE WATER	0	8,250	8,250	8,250	8,250	8,250
DROUGHT MANAGEMENT	0	0	0	0	0	0
NEW MAJOR RESERVOIR	0	0	0	0	0	0
OTHER CONSERVATION	0	0	0	0	0	0
INDIRECT REUSE	0	0	0	0	0	0
DIRECT POTABLE REUSE	0	0	0	0	0	0
SEAWATER DESALINATION	0	0	0	0	0	0
TOTAL STRATEGY SUPPLIES	**82,433**	**118,338**	**129,532**	**146,107**	**150,363**	**155,989**

* WMS type descriptions can be found on the interactive state water plan website at http://texasstatewaterplan.org/ using the 'View data for' drop-down menus to navigate to a specific WMS Type page. The data used to create each WMS type value is available in Appendix 3 of the Guidelines for Regional Water Planning Data Deliverable (Exhibit D) document at http://www.twdb.texas.gov/waterplanning/rwp/planningdocu/2021/doc/current_docs/contract_docs/ExhibitD.pdf.

Region E Water User Group (WUG)
Recommended Water Management Strategy (WMS) Supplies by Source Type

SOURCE SUBTYPE*	STRATEGY SUPPLY (ACRE-FEET PER YEAR)					
	2020	2030	2040	2050	2060	2070
AQUIFER STORAGE & RECOVERY	0	5,589	5,589	5,589	5,589	5,589
GROUNDWATER	34,903	55,468	66,295	77,188	78,130	78,970
GROUNDWATER TOTAL STRATEGY SUPPLIES	**34,903**	**61,057**	**71,884**	**82,777**	**83,719**	**84,559**
DIRECT NON-POTABLE REUSE	8,500	9,225	9,925	10,625	10,625	10,625
DIRECT POTABLE REUSE	0	0	0	0	0	0
INDIRECT NON-POTABLE REUSE	0	0	0	0	0	0
INDIRECT POTABLE REUSE	0	0	0	0	0	0
REUSE TOTAL STRATEGY SUPPLIES	**8,500**	**9,225**	**9,925**	**10,625**	**10,625**	**10,625**
ATMOSPHERE	0	0	0	0	0	0
GULF OF MEXICO	0	0	0	0	0	0
LIVESTOCK LOCAL SUPPLY	0	0	0	0	0	0
OTHER LOCAL SUPPLY	0	0	0	0	0	0
RAINWATER HARVESTING	0	70	70	70	70	70
RESERVOIR	0	3,250	3,250	3,250	3,250	3,250
RESERVOIR SYSTEM	0	0	0	0	0	0
RUN-OF-RIVER	5,000	10,000	10,000	10,000	10,000	10,000
SURFACE WATER TOTAL STRATEGY SUPPLIES	**5,000**	**13,320**	**13,320**	**13,320**	**13,320**	**13,320**
REGION E TOTAL STRATEGY SUPPLIES	**48,403**	**83,602**	**95,129**	**106,722**	**107,664**	**108,504**

* A full list of source subtype definitions can be found in section 3 of the Guidelines for Regional Water Planning Data Deliverable (Exhibit D) document at http://www.twdb.texas.gov/waterplanning/rwp/planningdocu/2021/doc/current_docs/contract_docs/ExhibitD.pdf.

Region E Major Water Provider (MWP) Existing Sales and Transfers

Major Water Providers are entities of particular significance to a region's water supply as defined by the Regional Water Planning Group (RWPG), and may be a Water User Group (WUG) entity, Wholesale Water Provider (WWP) entity , or both (WUG/WWP).

Retail denotes WUG projected demands and existing water supplies used by the WUG. Wholesale denotes a WWP or WUG/WWP selling water to another entity.

EL PASO COUNTY WID #1 - WWP	WATER VOLUMES (ACRE-FEET PER YEAR)					
DATA DESCRIPTION	**2020**	**2030**	**2040**	**2050**	**2060**	**2070**
PROJECTED WHOLESALE CONTRACT DEMANDS	80,774	80,774	80,774	80,774	80,774	80,774
TOTAL PROJECTED WHOLESALE CONTRACT AND RETAIL DEMANDS	**80,774**	**80,774**	**80,774**	**80,774**	**80,774**	**80,774**
REUSE SALES TO WHOLESALE CUSTOMERS	34,169	34,169	34,169	34,169	34,169	34,169
SURFACE WATER SALES TO WHOLESALE CUSTOMERS	46,605	46,605	46,605	46,605	46,605	46,605
TOTAL WHOLESALE AND RETAIL SALES TO CUSTOMERS	**80,774**	**80,774**	**80,774**	**80,774**	**80,774**	**80,774**

EL PASO WATER - WUG/WWP	WATER VOLUMES (ACRE-FEET PER YEAR)					
DATA DESCRIPTION	**2020**	**2030**	**2040**	**2050**	**2060**	**2070**
PROJECTED RETAIL WUG DEMANDS	110,572	120,315	129,713	139,978	150,601	160,792
PROJECTED WHOLESALE CONTRACT DEMANDS	26,331	26,331	26,331	26,331	26,331	26,331
TOTAL PROJECTED WHOLESALE CONTRACT AND RETAIL DEMANDS	**136,903**	**146,646**	**156,044**	**166,309**	**176,932**	**187,123**
GROUNDWATER SALES TO RETAIL CUSTOMERS	115,000	115,000	115,000	115,000	115,000	115,000
REUSE SALES TO RETAIL CUSTOMERS	6,000	6,000	6,000	6,000	6,000	6,000
SURFACE WATER SALES TO RETAIL CUSTOMERS	10,000	10,000	10,000	10,000	10,000	10,000
GROUNDWATER SALES TO WHOLESALE CUSTOMERS	26,331	26,331	26,331	26,331	26,331	26,331
TOTAL WHOLESALE AND RETAIL SALES TO CUSTOMERS	**157,331**	**157,331**	**157,331**	**157,331**	**157,331**	**157,331**

HORIZON REGIONAL MUD - WUG/WWP	WATER VOLUMES (ACRE-FEET PER YEAR)					
DATA DESCRIPTION	**2020**	**2030**	**2040**	**2050**	**2060**	**2070**
PROJECTED RETAIL WUG DEMANDS	7,936	11,043	13,962	16,868	19,630	22,235
TOTAL PROJECTED WHOLESALE CONTRACT AND RETAIL DEMANDS	**7,936**	**11,043**	**13,962**	**16,868**	**19,630**	**22,235**
GROUNDWATER SALES TO RETAIL CUSTOMERS	5,227	5,227	5,227	5,227	5,227	5,227
TOTAL WHOLESALE AND RETAIL SALES TO CUSTOMERS	**5,227**	**5,227**	**5,227**	**5,227**	**5,227**	**5,227**

LOWER VALLEY WATER DISTRICT - WUG/WWP	WATER VOLUMES (ACRE-FEET PER YEAR)					
DATA DESCRIPTION	**2020**	**2030**	**2040**	**2050**	**2060**	**2070**
PROJECTED RETAIL WUG DEMANDS	5,714	6,563	7,398	8,290	9,189	10,045
TOTAL PROJECTED WHOLESALE CONTRACT AND RETAIL DEMANDS	**5,714**	**6,563**	**7,398**	**8,290**	**9,189**	**10,045**
GROUNDWATER SALES TO RETAIL CUSTOMERS	4,356	4,356	4,356	4,356	4,356	4,356
TOTAL WHOLESALE AND RETAIL SALES TO CUSTOMERS	**4,356**	**4,356**	**4,356**	**4,356**	**4,356**	**4,356**

Region E Major Water Provider (MWP) Water Management Strategy (WMS) Summary

MWPs are entities of significance to a region's water supply as defined by the Regional Water Planning Group (RWPG) and may be a Water User Group (WUG) entity, Wholesale Water Provider (WWP) entity, or both (WUG/WWP).'MWP Retail Customers' denotes recommended WMS supply used by the WUG. 'Transfers Related to Wholesale Customers' denotes a WWP or WUG/WWP selling or transferring recommended WMS supply to another entity. Supply associated with the MWP's wholesale transfers will only display if it is listed as the main seller in the State Water Planning database, even if multiple sellers are involved with the sale of water to WUGs. Unallocated water volumes represent MWP recommended WMS supply not currently allocated to a customer of the MWP.'Total MWP Related WMS Supply' will display if the MWP's WMS is related to more than one WMS supply type (retail, wholesale, and/or unallocated). Associated WMS Projects are listed when the MWP is one of the project's sponsors. Report contains draft data and is subject to change.

EL PASO COUNTY WID #1 | NO RECOMMENDED WMS SUPPLY RELATED TO MWP

EL PASO WATER | EL PASO COUNTY (MANUFACTURING) - PURCHASE WATER FROM EPW

	WATER VOLUMES (ACRE-FEET PER YEAR)					
DATA DESCRIPTION	2020	2030	2040	2050	2060	2070
TRANSFERS RELATED TO WHOLESALE CUSTOMERS	0	860	860	860	860	860

EL PASO WATER | EL PASO COUNTY (SEP) - PURCHASE WATER FROM EPW

	WATER VOLUMES (ACRE-FEET PER YEAR)					
DATA DESCRIPTION	2020	2030	2040	2050	2060	2070
TRANSFERS RELATED TO WHOLESALE CUSTOMERS	7,260	7,260	7,260	7,260	7,260	7,260

EL PASO WATER | EL PASO COUNTY OTHER - (VINTON HILLS) - PURCHASE WATER FROM EPW

	WATER VOLUMES (ACRE-FEET PER YEAR)					
DATA DESCRIPTION	2020	2030	2040	2050	2060	2070
TRANSFERS RELATED TO WHOLESALE CUSTOMERS	0	0	0	10	73	133

EL PASO WATER | EPW - ADVANCED WATER PURIFICATION AT THE BUSTAMANTE WWTP

	WATER VOLUMES (ACRE-FEET PER YEAR)					
DATA DESCRIPTION	2020	2030	2040	2050	2060	2070
MWP RETAIL CUSTOMERS	8,500	9,200	9,900	10,600	10,600	10,600

WMS RELATED MWP SPONSORED PROJECTS	PROJECT DESCRIPTION
EPW - ADVANCED PURIFIED WATER AT THE BUSTAMANTE WWTP	CONVEYANCE/TRANSMISSION PIPELINE; INJECTION WELL; WATER TREATMENT PLANT EXPANSION; PUMP STATION

EL PASO WATER | EPW - GROUNDWATER FROM DELL CITY AREA (PHASE 1)

	WATER VOLUMES (ACRE-FEET PER YEAR)					
DATA DESCRIPTION	2020	2030	2040	2050	2060	2070
MWP RETAIL CUSTOMERS	0	0	10,000	10,000	10,000	10,000

WMS RELATED MWP SPONSORED PROJECTS	PROJECT DESCRIPTION
EPW - GROUNDWATER FROM DELL CITY AREA (PHASE 1)	CONVEYANCE/TRANSMISSION PIPELINE; MULTIPLE WELLS/WELL FIELD; NEW WATER TREATMENT PLANT; PUMP STATION; STORAGE TANK

EL PASO WATER | EPW - GROUNDWATER FROM DELL CITY AREA (PHASE 2)

	WATER VOLUMES (ACRE-FEET PER YEAR)					
DATA DESCRIPTION	2020	2030	2040	2050	2060	2070
MWP RETAIL CUSTOMERS	0	0	0	10,000	10,000	10,000

WMS RELATED MWP SPONSORED PROJECTS	PROJECT DESCRIPTION
EPW - GROUNDWATER FROM DELL CITY AREA (PHASE 2)	CONVEYANCE/TRANSMISSION PIPELINE; MULTIPLE WELLS/WELL FIELD; NEW WATER TREATMENT PLANT; PUMP STATION; STORAGE TANK

EL PASO WATER | EPW - HUECO BOLSON ARTIFICIAL RECHARGE

	WATER VOLUMES (ACRE-FEET PER YEAR)					
DATA DESCRIPTION	2020	2030	2040	2050	2060	2070
MWP RETAIL CUSTOMERS	0	5,000	5,000	5,000	5,000	5,000

Region E Major Water Provider (MWP) Water Management Strategy (WMS) Summary

WMS RELATED MWP SPONSORED PROJECTS	PROJECT DESCRIPTION
EPW - HUECO BOLSON ARTIFICIAL RECHARGE	CONVEYANCE/TRANSMISSION PIPELINE; DIVERSION AND CONTROL STRUCTURE

EL PASO WATER | EPW - MUNICIPAL CONSERVATION PROGRAM

DATA DESCRIPTION	WATER VOLUMES (ACRE-FEET PER YEAR)					
	2020	2030	2040	2050	2060	2070
MWP RETAIL CUSTOMERS	4,950	5,530	5,080	9,940	13,140	17,820

WMS RELATED MWP SPONSORED PROJECTS	PROJECT DESCRIPTION
EPW - MUNICIPAL CONSERVATION PROGRAM	CONSERVATION - MUNICIPAL (DOES NOT INCLUDE METER REPLACEMENT OR WATER LOSS); WATER LOSS CONTROL

EL PASO WATER | LVWD - PURCHASE WATER FROM EPW

DATA DESCRIPTION	WATER VOLUMES (ACRE-FEET PER YEAR)					
	2020	2030	2040	2050	2060	2070
TRANSFERS RELATED TO WHOLESALE CUSTOMERS	1,344	2,185	3,012	3,895	4,785	5,632

HORIZON REGIONAL MUD | HORIZON REGIONAL MUD - ADDITIONAL WELLS AND EXPANSION OF DESALINATION PLANT

DATA DESCRIPTION	WATER VOLUMES (ACRE-FEET PER YEAR)					
	2020	2030	2040	2050	2060	2070
MWP RETAIL CUSTOMERS	16,786	16,786	16,786	16,786	16,786	16,786

WMS RELATED MWP SPONSORED PROJECTS	PROJECT DESCRIPTION
HORIZON REGIONAL MUD - ADDITIONAL WELLS AND EXPANSION OF DESAL PLANT	CONVEYANCE/TRANSMISSION PIPELINE; MULTIPLE WELLS/WELL FIELD; WATER TREATMENT PLANT EXPANSION

HORIZON REGIONAL MUD | HORIZON REGIONAL MUD - PUBLIC CONSERVATION EDUCATION

DATA DESCRIPTION	WATER VOLUMES (ACRE-FEET PER YEAR)					
	2020	2030	2040	2050	2060	2070
MWP RETAIL CUSTOMERS	79	110	140	169	196	222

HORIZON REGIONAL MUD | HORIZON REGIONAL MUD - WATER LOSS AUDIT AND MAIN-LINE REPAIR

DATA DESCRIPTION	WATER VOLUMES (ACRE-FEET PER YEAR)					
	2020	2030	2040	2050	2060	2070
MWP RETAIL CUSTOMERS	197	274	346	418	487	551

WMS RELATED MWP SPONSORED PROJECTS	PROJECT DESCRIPTION
HORIZON REGIONAL MUD - WATER LOSS AUDIT AND MAIN-LINE REPAIR	WATER LOSS CONTROL

LOWER VALLEY WATER DISTRICT | LVWD - GROUNDWATER FROM PROPOSED WELL FIELD - HUECO BOLSON AQUIFER

DATA DESCRIPTION	WATER VOLUMES (ACRE-FEET PER YEAR)					
	2020	2030	2040	2050	2060	2070
MWP RETAIL CUSTOMERS	0	6,800	6,800	6,800	6,800	6,800

WMS RELATED MWP SPONSORED PROJECTS	PROJECT DESCRIPTION
LVWD - GROUNDWATER FROM PROPOSED WELL FIELD - HUECO BOLSON AQUIFER	CONVEYANCE/TRANSMISSION PIPELINE; INJECTION WELL; MULTIPLE WELLS/WELL FIELD; NEW WATER TREATMENT PLANT; PUMP STATION; STORAGE TANK

LOWER VALLEY WATER DISTRICT | LVWD - GROUNDWATER FROM PROPOSED WELL FIELD - RIO GRANDE ALLUVIUM AQUIFER

DATA DESCRIPTION	WATER VOLUMES (ACRE-FEET PER YEAR)					
	2020	2030	2040	2050	2060	2070
MWP RETAIL CUSTOMERS	0	6,800	6,800	6,800	6,800	6,800

WMS RELATED MWP SPONSORED PROJECTS	PROJECT DESCRIPTION
LVWD - GROUNDWATER FROM PROPOSED WELL FIELD - RIO GRANDE ALLUVIUM AQUIFER	CONVEYANCE/TRANSMISSION PIPELINE; INJECTION WELL; MULTIPLE WELLS/WELL FIELD; NEW WATER TREATMENT PLANT; PUMP STATION; STORAGE TANK

Region E Major Water Provider (MWP) Water Management Strategy (WMS) Summary

LOWER VALLEY WATER DISTRICT | LVWD - PUBLIC CONSERVATION EDUCATION						
	WATER VOLUMES (ACRE-FEET PER YEAR)					
DATA DESCRIPTION	2020	2030	2040	2050	2060	2070
MWP RETAIL CUSTOMERS	57	66	74	83	92	100

LOWER VALLEY WATER DISTRICT | LVWD - PURCHASE WATER FROM EPW						
	WATER VOLUMES (ACRE-FEET PER YEAR)					
DATA DESCRIPTION	2020	2030	2040	2050	2060	2070
MWP RETAIL CUSTOMERS	1,344	2,185	3,012	3,895	4,785	5,632

LOWER VALLEY WATER DISTRICT | LVWD - SURFACE WATER TREATMENT PLANT AND TRANSMISSION LINE						
	WATER VOLUMES (ACRE-FEET PER YEAR)					
DATA DESCRIPTION	2020	2030	2040	2050	2060	2070
MWP RETAIL CUSTOMERS	0	5,000	5,000	5,000	5,000	5,000
WMS RELATED MWP SPONSORED PROJECTS	PROJECT DESCRIPTION					
LVWD - SURFACE WATER TREATMENT PLANT AND TRANSMISSION LINES	CONVEYANCE/TRANSMISSION PIPELINE; NEW AGREEMENT; NEW SURFACE WATER INTAKE; NEW WATER TREATMENT PLANT; PUMP STATION					

LOWER VALLEY WATER DISTRICT | LVWD - WASTEWATER TREATMENT FACILITY AND ASR						
	WATER VOLUMES (ACRE-FEET PER YEAR)					
DATA DESCRIPTION	2020	2030	2040	2050	2060	2070
MWP RETAIL CUSTOMERS	0	5,589	5,589	5,589	5,589	5,589
WMS RELATED MWP SPONSORED PROJECTS	PROJECT DESCRIPTION					
LVWD - WASTEWATER TREATMENT AND ASR FACILITY	CONVEYANCE/TRANSMISSION PIPELINE; INJECTION WELL; NEW WATER TREATMENT PLANT					

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CHAPTER 1
FAR WEST TEXAS DESCRIPTION

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1 FAR WEST TEXAS

Far West Texas encompasses the most arid region of the State of Texas (Figure 1-1). Residents of this expansive desert environment recognize that water is a scarce and valuable resource that must be developed and managed with great care to ensure the area's long-term viability. The Region's economic health and quality of life are dependent on a sustainable water supply that is equitably managed.

Chapter 1 presents a broad descriptive overview of Far West Texas including currently existing water management facilities and international water issues. This chapter also summarizes specific planning components that are presented in more detail elsewhere in this *Plan*, such as projected population and water demand and available water-supply sources to meet these anticipated demands. Also provided in this chapter is a listing of State and Federal agencies, universities, and private organizations that are involved in various aspects of water supply issues.

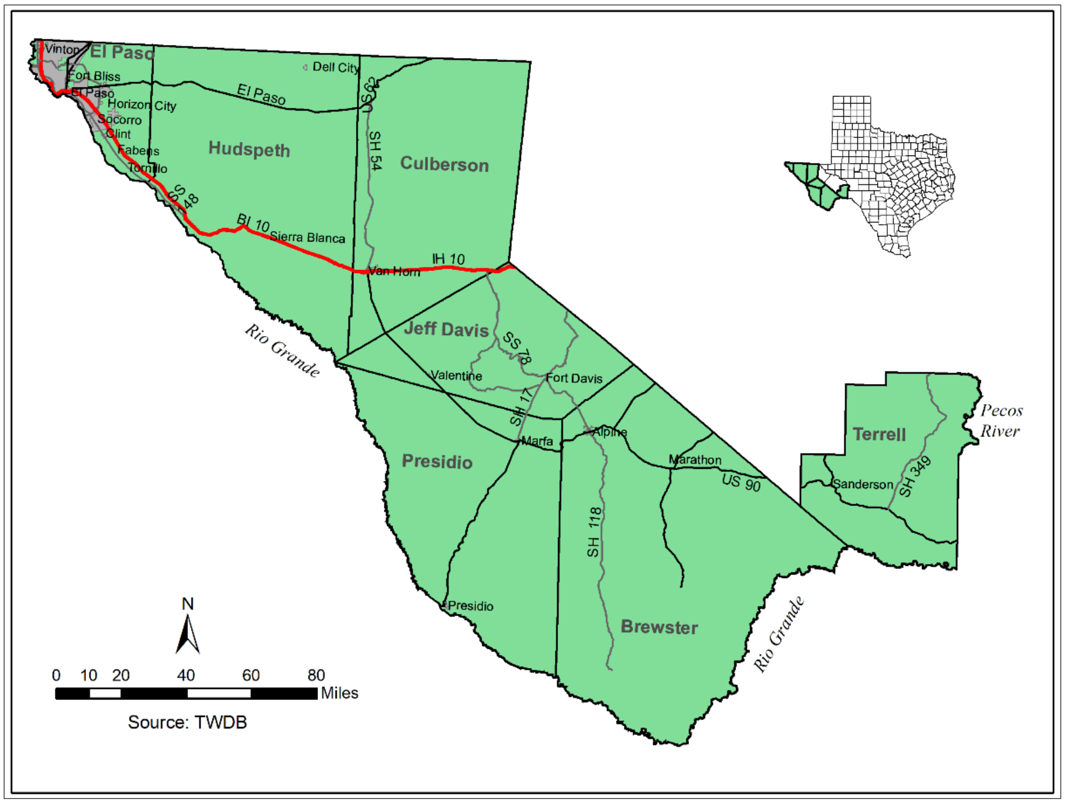

Figure 1-1. Location of Far West Texas

1.1 WATER PLANNING AND MANAGEMENT

1.1.1 Regional Water Planning

The *2021 Far West Texas Water Plan* follows an identical format as the plans prepared by the other 15 water planning regions in the State as mandated by the Texas Legislature and overseen by the Texas Water Development Board. The *Plan* provides an evaluation of current and future water demands for all water-use categories, and water supplies available during drought-of-record conditions to meet those demands. Where future water demands exceed an entity's ability to supply that need, alternative strategies are considered to meet the potential water shortages. Water management strategies are also presented that reflects an entity's desire to upgrade their water supply system. In all cases, conservation practices are first considered in managing water supplies.

In January of 2016, the fourth round of regional water planning was concluded with the adoption of the *2016 Far West Texas Water Plan*. It is understood that this *Plan* was not a static plan but rather is intended to be revised as conditions change. For this reason, the current *2021 Plan* put forth in this document is not a new plan, but rather an evolutionary modification of the preceding *2016 Plan*. Only those parts of the previous *Plan* that require updating, and there are many, have been revised.

The purpose of the *2021 Far West Texas Water Plan* is to provide a document that water planners and users can reference for long- and short-term water management recommendations. Equally important, this *Plan* serves as an educational tool to inform all citizens of the importance of properly managing and conserving the delicate water resources of this desert community.

Previous regional and state water plans have been aligned with political boundaries, such as city limits rather than water utility service areas. Recent TWDB rule changes now define a municipal water user group (WUG) as being utility-based, and thus the emphasis of the development of population and municipal water demands for the 2021 regional water plans transition from political boundaries to utility-service area boundaries.

Because our understanding of current and future water demand and supply sources is constantly changing, it is intended for this *Plan* to be revised every five years or sooner if deemed necessary. This *Plan* fully recognizes and protects existing water rights, water contracts, and option agreements. There are no known conflicts between this *Plan* and plans prepared for other regions. Publicly available water plans of major agricultural, municipal and commercial water users were considered in the development of this *Plan*, primarily as they relate to Chapter 5 recommended water management strategies, Chapters 5 and 7 conservation and drought topics.

The Far West Texas Water Planning Group (FWTWPG) is a voluntary association comprised of voting and non-voting members whom represent a minimum of 11 water use categories. Since 1997, the planning group has been involved in a wide range of projects, programs and the development of the regional water plan. All meetings and activities of the FWTWPG met all requirements under the Texas Open Meetings Act.

Water supply availability under drought-of-record conditions is considered in the planning process to ensure that water demands can be met under the most challenging hydrologic circumstances. For surface water supplies, drought-of-record conditions relate to the quantity of water available to meet existing permits from the Rio Grande and the Pecos River as estimated by the TCEQ Rio Grande Water Availability Model (WAM). This *2021 Plan* has no impact on navigation on these surface water courses.

The availability of groundwater during drought-of-record conditions is based on the Modeled Available Groundwater (MAG) volumes that may be produced on an average annual basis to achieve a Desired Future Condition (DFC) as adopted by Groundwater Management Areas (GMAs) (per Texas Water Code §36.001). Groundwater availability volumes for parts of the Region where MAGs are not determined by the TWDB are calculated separately. Chapter 3 contains a detailed analysis of water supply availability in the Region.

Since the completion of the *2016 Far West Texas Water Plan*, several changed conditions have occurred in the Region which warrants this 2021 updated water *Plan*. The latest census (2010) is the baseline for estimates of population and municipal/rural water demand projections. Groundwater and surface water availability models (GAMs and WAMs) have been developed as resource tools for use in evaluating water-supply source availability.

This current *Plan* continues to rely on environmental data on the more prominent watercourses in the Region as contributed by the Texas Parks & Wildlife Department, the National Parks Service, and the Texas Nature Conservancy. This data was useful in the assessment and consideration of environmental flow needs, springs, and ecologically unique stream segments.

The FWTWPG strongly encourages all entities to participate in the planning process so that their specific concerns can be recognized and addressed. The Group also encourages the participation of Groundwater Conservation Districts (GCDs) and recognizes their management plans and rules. District management plans are specifically respected when establishing groundwater availability estimates.

Water quality is recognized as an important component in this 50-year water plan. Water supplies can be diminished or made costlier to prepare for distribution if water quality is compromised (Section 1.8). To ensure that this *Plan* fully considers water quality, the Federal Clean Water Act and the State Clean Rivers Program were reviewed and considered when developing water-supply availability estimates (Chapter 3), water management strategies water quality impacts (Chapter 5), and recommendations (Chapter 8).

1.1.2 Interim Regional Water Supply Research Projects

Previous planning periods included research projects that provided important scientific data or water strategy analysis that was beyond the normal range of regional planning activities, but provided important insight and accuracy to the overall planning process. Reports of the results of these studies listed below are available at the Rio Grande Council of Governments website (http://westtexaswaterplanning.org/) or from the TWDB website (http://www.twdb.texas.gov/publications/reports/index.asp). Information gained from these projects is also incorporated in specific water-supply management strategies discussed in Chapter 5.

- Igneous Aquifer System of Brewster, Jeff Davis and Presidio Counties, Texas (2001)
- West Texas Bolsons and Igneous Aquifer System Groundwater Availability Model Data Collection (2003)
- Conceptual Evaluation of Surface Water Storage in El Paso County (2008)

- Far West Texas Climate Change Conference (2008)
- Groundwater Data Acquisition in Far West Texas (2009)
- Evaluation of Irrigation Efficiency Strategies for Far West Texas: Feasibility, Water Savings and Cost Considerations (2009)
- Water Conservation Conference for Far West Texas Water Plan Region E (2009)
- Groundwater Data Acquisition and Analysis for the Marathon and Edwards-Trinity (Plateau) Aquifers (2010)

1.1.3 State Water Plan

The Texas Water Development Board adopted *Water for Texas 2017* as the latest official Texas State Water Plan. The Texas Water Code directs the TWDB to periodically update this comprehensive water plan, which is used as a guide to State water policy. The 2017 State Water Plan is the fourth water plan to incorporate water management and policy decisions made at the regional level as expressed in the 16 approved regional water plans.

1.1.4 Groundwater Conservation Districts

The Texas Legislature has established a process for local management of groundwater resources through Groundwater Conservation Districts (GCDs). GCDs are charged to manage groundwater by providing for the conservation, preservation, protection, recharging and prevention of waste of groundwater within their jurisdictions. An elected or appointed board governs these districts and establishes rules, programs and activities specifically designed to address local problems and opportunities. Texas Water Code §36.0015 states, in part, "Groundwater Conservation Districts created as provided by this chapter are the State's preferred method of groundwater management." Six districts are currently in operation within Far West Texas (Figure 1-2) and their management goals are discussed in further detail in Chapter 6.

- Brewster County Groundwater Conservation District
- Culberson County Groundwater Conservation District
- Hudspeth County Underground Water Conservation District #1
- Jeff Davis County Underground Water Conservation District
- Presidio County Underground Water Conservation District
- Terrell County Groundwater Conservation District

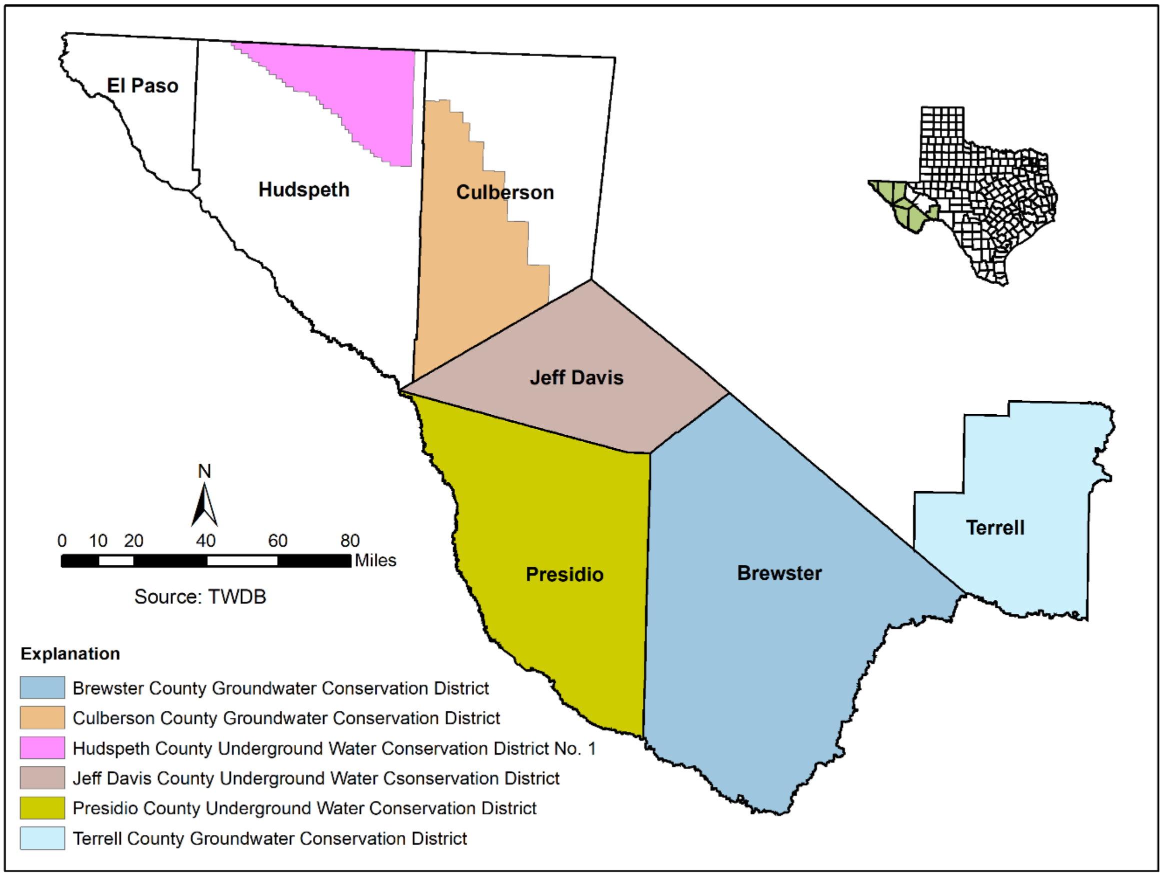

Figure 1-2. Groundwater Conservation Districts

1.1.5 Groundwater Management Areas

In recent sessions, the Texas Legislature has redefined the manner in which groundwater is to be managed (http://www.twdb.texas.gov/groundwater/management_areas/index.asp). Senate Bill 2 of the 77th Texas Legislature (2001) authorized:

- The Texas Water Development Board (TWDB) to designate Groundwater Management Areas that would include all major and minor aquifers of the State.
- The requirement of Groundwater Conservation Districts to share groundwater plans with other districts in the Groundwater Management Area.
- A Groundwater Conservation District to call for joint planning among districts in a Groundwater Management Area.

The objective was to delineate areas considered suitable for management of groundwater resources. A Groundwater Management Area (GMA) should ideally coincide with the boundaries of a groundwater reservoir (aquifer) or a subdivision of a groundwater reservoir, but it may also be defined by other factors, including the boundaries of political subdivisions. In December 2002, the TWDB designated 16 GMAs covering the entire state (http://www.twdb.texas.gov/mapping/maps.asp).

In 2005, the Legislature once again changed the direction of groundwater management. The new requirements, codified in Texas Water Code Chapter 36.108, required joint planning in management areas among Groundwater Conservation Districts. The new requirements indicate that,

"Not later than September 1, 2010, and every five years thereafter, the districts shall consider groundwater availability models and other data or information for the management area and shall establish desired future conditions for the relevant aquifers within the management area."

Desired Future Conditions (DFCs) are a description of the aquifers at some time in the future. This description is a precursor to developing a volumetric number called Modeled Available Groundwater (MAG). The TWDB is responsible for providing each Groundwater Conservation District and regional water planning group, located wholly or partly in the management area, with MAG volumes. Once the MAG is determined, the districts begin issuing groundwater withdrawal permits to support the Desired Future Condition (DFC) of the aquifer up to the total amount of the MAG. These permits express DFCs by only allowing withdrawals that will support the conditions established by the groundwater management area. Regional water plans must also incorporate the MAG for each aquifer within their regions. The counties of Far West Texas are included in three Groundwater Management Areas:

- GMA 4 includes Brewster, Culberson, part of Hudspeth, Jeff Davis and Presidio
- GMA 5 includes El Paso and part of Hudspeth
- GMA 7 includes Terrell

This *2021Far West Texas Water Plan* includes a significant revision to groundwater source availability estimates based on MAG volumes generated from the GMA process for those aquifers that are managed by the Groundwater Conservation Districts.

1.1.6 El Paso Water as the Declared Regional Water Supply Planner

In 1995, the Texas Legislature passed Senate Bill 450 designating the El Paso Water Utilities/Public Service Board (now El Paso Water) as the regional water and wastewater planner for El Paso County. The purpose of the Bill is to improve regional water and wastewater planning for El Paso County and encourage increased consultation, coordination, and cooperation in the management of regional water resources. The City of El Paso serves a pivotal role in all future planning and expansion projects. The City, through El Paso Water, receives priority consideration for public funding for the planning, design, and construction of water supply and wastewater systems within the County. The intent of Senate Bill 450 is to address regional planning issues by the following seven actions:

- Coordinate water and wastewater management on a regional watershed basis
- Address water quality and quantity conditions adversely affecting the public health and the environment
- Provide efficient planning and management of water resources to mitigate existing and avoid future negative colonia conditions
- Participate in water and wastewater planning with adjacent counties and the border states of New Mexico and Chihuahua, Mexico, to address transboundary water issues

- Encourage conjunctive management for the protection and preservation of the limited surface water and groundwater resources
- Maximize the amounts and provide for the efficient use of public funding to implement the purposes of Senate Bill 450
- Provide intergovernmental cooperation with water utilities to encourage their planning to be consistent with the regional plan

1.1.7 El Paso County Priority Groundwater Management Area

In 1985, the 69th Texas Legislature recognized that certain areas of the State were experiencing or were expected to experience critical groundwater problems. House Bill 2 directed the Texas Department of Water Resources (later to become the Texas Water Commission (TWC) and the Texas Water Development Board (TWDB)) to identify the "critical" groundwater areas in the State, to conduct studies in those areas, and to make recommendations on whether a GCD should be established in critical areas. Senate Bill 1 changed the name of "Critical Area" to "Priority Groundwater Management Area" (PGMA) and mandated that the Texas Natural Resource Conservation Commission (TNRCC - successor agency to the TWC and later to be named TCEQ) complete reviews of all pending PGMA studies.

The PGMA process is initiated by TCEQ, who designates a PGMA when an area is experiencing critical groundwater problems, or is expected to do so within 25 years. These problems include shortages of surface water or groundwater, land subsidence resulting from groundwater withdrawal, or contamination of groundwater supplies. Once an area is designated a PGMA, landowners have two years to create a GCD. Otherwise, the TCEQ is required to create a GCD or to recommend that the area be added to an existing district. The TWDB works with the TCEQ to produce a legislative report every two years on the status of PGMAs in the State. The PGMA process is completely independent of the current Groundwater Management Area process as each process has different goals. The goal of the PGMA process is to establish GCDs in these designated areas so that there will be a regulating entity to address the identified groundwater issues. PGMAs are still relevant if there remain portions within these designated areas without GCDs. A statewide map of the declared PGMA areas is available at: https://www.tceq.texas.gov/groundwater/pgma.html.

The TWC and TWDB evaluated groundwater supply conditions in El Paso County in 1990 as part of the PGMA program. An overview evaluation (TWDB Report 324) recognized that the Hueco Bolson Aquifer had a long history of water-level decline and water-quality deterioration, and the expected life of the aquifer, under then current understanding, was about 60 years at best. However, rather than declaring the area "Critical," the TWC placed a moratorium over the declaration until after the completion of a 50-year City of El Paso water management plan.

The TNRCC requested a technical update study of El Paso County, which was completed in the spring of 1998 (TWDB Open-File Report, Preston, 1998; and TPWD Report, El-Hage and Moulton, 1998). The TWDB report concluded that water-level declines and quality deterioration are still present in the Hueco Bolson, but did not address El Paso's plans to remedy the problems and provide long-term management. The TPWD reported no known effect on wildlife as a result of water-level declines in the Hueco Bolson Aquifer. TNRCC staff then completed their analysis and recommended to their Commissioners that the area identified by the TWDB as the Hueco Bolson Aquifer in El Paso County be declared a PGMA (TNRCC File Report, Musick, 1998). The Commissioners, subsequently, declared "the area of El Paso

County overlying the Hueco Bolson Aquifer, including its subcrops and outcrops*"* as a PGMA. However, the Commissioners stated that,

> *"El Paso has clearly demonstrated a significant effort toward regional cooperation, planning, and voluntary implementation of actions to address water supply problems" and that "it is not clear that creating a groundwater conservation district for the area of El Paso County overlying the Hueco Bolson Aquifer would be in the public interest, meet a public need, or benefit the property therein at this time."*
>
> *(TNRCC Docket No. 98-0999-MLM, SOAH Docket No. 582-98-1540).*

Since the conclusion of this action, El Paso County Commissioner's Court has not promulgated any water availability requirements within the County.

1.1.8 Hudspeth County Priority Groundwater Management Area Consideration

In March 2005, Texas Commission on Environmental Quality (TCEQ) released a report titled Evaluation for the Hudspeth County Priority Groundwater Management Study Area. The purpose of this evaluation was to determine if the Hudspeth County area is experiencing, or is expected to experience within the next 25 years, critical groundwater problems, and whether a GCD should be created to address such problems. The study area included all of Hudspeth County; however only the area outside of the Hudspeth County Underground Water Conservation District No. 1 was considered for PGMA designation.

For this report, TCEQ staff considered comments, data, and information provided by several different sources including water stakeholders from within the study area, the TWDB, the TPWD, the FWTWPG, and independent research by the staff. The report discusses the available authority and management practices of existing groundwater management entities within and adjacent to the study area and makes recommendations on appropriate strategies needed to conserve and protect local groundwater resources.

The water supply problems identified in the study area include widespread total dissolved solids concentrations in groundwater and the lack of firm alternative supplies for irrigation use in the Rio Grande Valley during drought-of-record conditions. Groundwater concerns expressed by area stakeholders included sustainability, water quality, availability, access to alternative water supplies, and the possibility of water exportation.

The TCEQ concluded that the identified water supply and water quality issues are not presently critical problems and are not anticipated to be critical during the next 25-year planning horizon, and that the Hudspeth County study area should not be designated as a PGMA at this time. However, the TCEQ also acknowledges that the creation of a GCD is a feasible and practicable groundwater management option for citizens of the study area to consider.

1.2 FAR WEST TEXAS GEOGRAPHIC SETTING

Located in the westernmost region of the State, Far West Texas is bounded on the north by New Mexico, on the south and west by the Rio Grande and the United Mexican States, and on the east by the Pecos River; and incorporates the counties of Brewster, Culberson, El Paso, Hudspeth, Jeff Davis, Presidio and Terrell. These counties claim some of the most impressive topography and scenic beauty in Texas. The Region is home to the Guadalupe Mountains National Park, Big Bend National Park, and the contiguous Big Bend Ranch State Park. El Paso, the largest city in the Region, is also the nation's largest city on the U.S.-Mexico border. Ciudad Juarez, with an estimated population of over 1.5 million, is located across the Rio Grande from the City of El Paso and shares the same water sources with El Paso.

All seven counties that comprise the planning Region lie solely within the Rio Grande River Basin. While the entire planning region falls within the Rio Grande River Basin, the region is occupied by several internally-drained closed basins (bolsons). The Rio Grande not only forms the border between the United States and Mexico but is also a vital water-supply source for communities, industries, and agricultural activities adjacent to the River. Above Fort Quitman, use of water from the Rio Grande is controlled primarily by the operations of the Rio Grande Project, which was established to supply agricultural water in southern New Mexico and Far West Texas. Other than along the Rio Grande corridor, the Region is dependent on groundwater resources derived from several aquifer systems.

The counties of Far West Texas are among the largest in the State, occupying 24,069 square miles (mi^2), or 9 percent of the total State area. Ranked by total area, the counties that make up the Region are Brewster (6,193 mi^2), Hudspeth (4,572 mi^2), Presidio (3,856 mi^2), Culberson (3,813 mi^2), Terrell (2,358mi^2), Jeff Davis (2,264 mi^2), and El Paso (1,013 mi^2).

1.2.1 Physiography

Far West Texas is in a topographically distinct area of North America known as the Basin and Range Physiographic Province and is characterized by higher elevations and greater local relief than is observed anywhere else in the State. Traversed from north to south by an eastern range of the Rocky Mountains, the Region contains all of Texas' true mountains (Figure 1-3). Widely spaced mountain ranges rise from 1,000 to more than 3,000 feet above the intervening basin lowlands.

Although most of Texas is generally flat and less than 2,500 feet above mean sea level, the floors of most of the basins in Far West Texas are at elevations greater than 3,000 feet. The basins (or bolsons) are filled with sediments eroded from the surrounding mountains. At the deepest points of the basins, deposits of basin-fill range in thickness from less than 1,000 feet to more than 9,000 feet. Except for the Rio Grande and its tributaries, the Rio Conchos (Chihuahua, Mexico) and the Pecos River (Texas), all surface water in the Region drains toward the lowest elevation within each basin. "Salt Flats" occur in northeastern Hudspeth and northwestern Culberson Counties where water, upwelling from shallow aquifers and collecting from rainfall runoff, rapidly evaporates leaving behind accumulations of mineral deposits. These lakes are dry during periods of low rainfall, exposing salt-incrusted basin flats. For years, this area was a source of commercial salt extraction.

Highest of the mountain ranges are the Guadalupe Mountains, which straddle the Texas-New Mexico state line. The highest elevations in the range are Guadalupe Peak (the highest surface elevation in Texas at 8,751 feet) and El Capitan, which overlook the Salt Basin to the west and south. Lying west of the Salt Basin and extending to the Hueco Mountains a short distance east of El Paso is the Diablo Plateau.

Other mountain ranges, including the Eagle, Quitman, Carrizo, Delaware, and Sierra Vieja Mountains, are located south and east of the Diablo Plateau in Culberson, Hudspeth, Jeff Davis, and Presidio Counties. These mountains overlook several intermountain basins from which there is no external drainage (e.g., Eagle Flat, Ryan Flat, Michigan Flat, and Wild Horse Flat). Two other basins, Red Light Draw and Green River Valley, are dissected by and drain to the Rio Grande.

The Davis Mountains are principally in Jeff Davis County; however, igneous rocks originating from volcanic vents that formed the Davis Mountains extend into Brewster, Hudspeth, and Presidio Counties. The Davis Mountains contain peaks with elevations greater than 7,000 feet, including Mount Livermore, which at 8,206 feet is one of the highest peaks in Texas. Mount Locke at 6,809 feet is home to the University of Texas McDonald Observatory. These peaks intercept moisture-bearing winds and receive more precipitation than other locations in West Texas. The Davis Mountains are greener than other mountains of the Region with the growth of grass and forest trees.

The Big Bend country, which lies southeast of the Davis Mountains, is bounded on three sides by a great eastward swing of the Rio Grande, which gives it its name. It is a sparsely populated mountainous country with scant rainfall. Its principal mountains, the Chisos, rise to an elevation of 7,825 feet. Along the Rio Grande are the Santa Elena, Mariscal, and Boquillas Canyons, with rim elevations of 3,500 feet to 3,775 feet. Because of its remarkable topography and plant and animal life, the southern part of this Region along the Rio Grande is home to Big Bend National Park and Big Bend Ranch State Park.

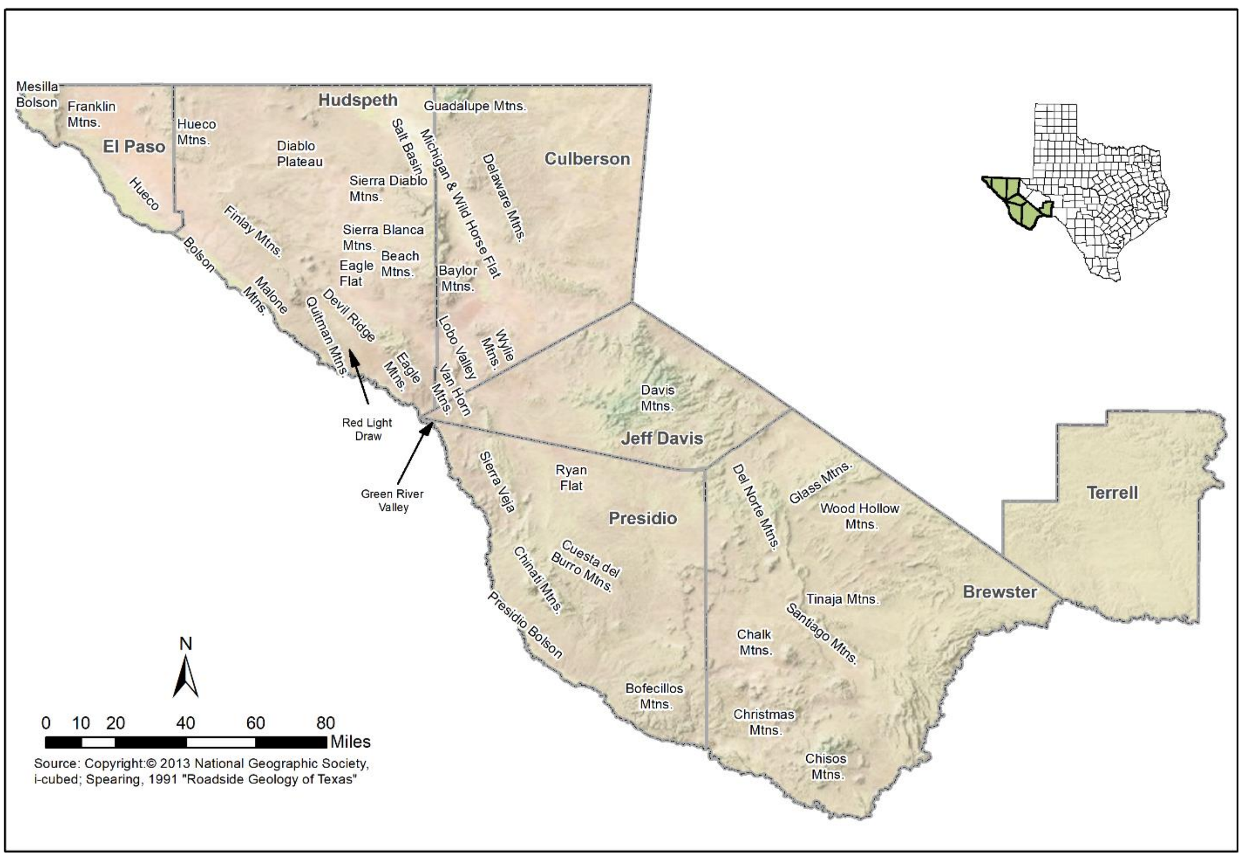

Figure 1-3 Mountains and Basins

In El Paso County, the Franklin Mountains rise 3,000 feet above the adjacent Rio Grande valley floor to an elevation of 7,192 feet, and separate the "Upper and Lower Valleys" of the Rio Grande, as well as the Mesilla and Hueco Bolsons. The historic towns and missions of Ysleta, Socorro and San Elizario are located along the Lower Valley.

1.2.2 Population and Regional Economy

Apart from El Paso County, the counties of Far West Texas are among the least populated in the State. In the year 2020, approximately 97 percent (925,565) of the Region's 954,035 residents are projected to reside in El Paso County, where the population density is 914 persons per square mile (Figure 1-4). The population density of the six rural counties is approximately one person per square mile. Approximately 75 percent of the residents in the Region are Hispanic or Latinos.

The City of El Paso, one of the fastest growing cities in Texas, is the largest city in the Region, with a year-2020 projected population of 734,031. This is 79 percent of the total population of El Paso County and 77 percent of the Region's total population.

The year-2020 projected populations of cities in the six rural counties are as follows: Alpine, Brewster County (6,066); Van Horn, Culberson County (2,319); Sierra Blanca, Hudspeth County (620); Fort Davis, Jeff Davis County (1,264); Marfa, Presidio County (2,203); Presidio, Presidio County (4,867); Sanderson, Terrell County (889). Population of other smaller communities such as Fort Hancock, Del City, Marathon and Valentine are included in the "County Other" (rural) population of each county. The "County Other" rural population of the Region is 48,664, or five percent of the total Regional population. The current and projected population growth in Far West Texas is further discussed in Chapter 2.

The regional economy is predominantly comprised of agriculture, agribusiness, manufacturing, tourism, wholesale and retail trade, government, and military. According to TWDB's socio-economic analysis (provided in Appendix 6A), the Far West Texas Regional economy generates about $35 billion in gross state product for Texas and supports roughly 435,000 jobs.

The dominant commercial land use throughout the rural areas of the Region is extensive cattle grazing. Aridity and historic land-tenure practices have combined to produce large ranches and low animal densities. Dairy operations in El Paso County represent the largest proportion of the market valuation for livestock, as El Paso County traditionally ranks in the top five dairy-production counties in Texas. Floodplain-irrigated agriculture is found along the Rio Grande extending above and below El Paso and into southern Hudspeth County. A much smaller irrigated strip also occurs along the River near Presidio. Currently, irrigated agriculture based on groundwater pumping is essentially limited to Dell Valley in northeastern Hudspeth County, Diablo Farms in northwestern Culberson County, and Wild Horse and Lobo Flats near Van Horn.

An innovative agricultural industry has developed in Jeff Davis and Presidio Counties where large greenhouse facilities have been constructed and successfully operated to produce hydroponically grown tomatoes. The Jeff Davis County and Presidio County Underground Water Conservation Districts permit well use for these two facilities and thus have records of their annual groundwater use. Although small compared to large-scale farming operations elsewhere in the Region, the Districts do strive to ensure that this innovative industry is recognized in the Regional Water Plan.

The new Tornillo-Guadalupe International Bridge border crossing in El Paso County was completed in 2014 and replaces the existing Fabens-Caseta International Bridge. The crossing, capable of handling modern day commercial, automobile and pedestrian traffic, supports the expansion of trade and economic growth on both sides of the border. In the El Paso area, the new crossing allows continued expansion of jobs in related industries such as trucking, warehousing, transshipping, and manufacturing; and according to the border economic plan for El Paso County also allows expansion of employment opportunities along IH-10 near the intersection of traffic from Tornillo and Fabens. In Mexico, the project provides an additional crossing that accommodates the expansion of maquiladora plants eastward from Juarez. By 2025, total annual vehicle crossings, both north and south, are expected to be over 900 thousand. Commercial truck traffic that previously traveled through downtown El Paso and Juarez is now able to move through the new crossing beyond the congested urban core, thus reducing air and noise pollution.

In the past several years, the Barnett Shale play has become the largest natural gas play in the State of Texas. This productive geologic formation has equivalent rock units (Woodford) that extend into West Texas. Although gas production from these formations in West Texas have not generally proven to be as prolific as those in the Fort Worth area, exploration interest has caused water planners to pay attention to an industry with potential high water needs. In a concerted effort to derive meaningful water use estimates for all mining applications, including the oil and gas industry, a TWDB report (*Current and Projected Water Use in the Texas Mining and Oil and Gas Industry, 2011 and 2012*) estimates water use for mining, (which includes water used for drilling operations such as rig supply), water flooding, and fracking in two reports. These estimates determined a water use volume per oil and gas well. Estimates from these reports indicate that Culberson and Terrell Counties had the greatest demand by the oil and gas industry within the Far West Texas Region. None of the other counties in the Region have reported any significant usage by the industry.

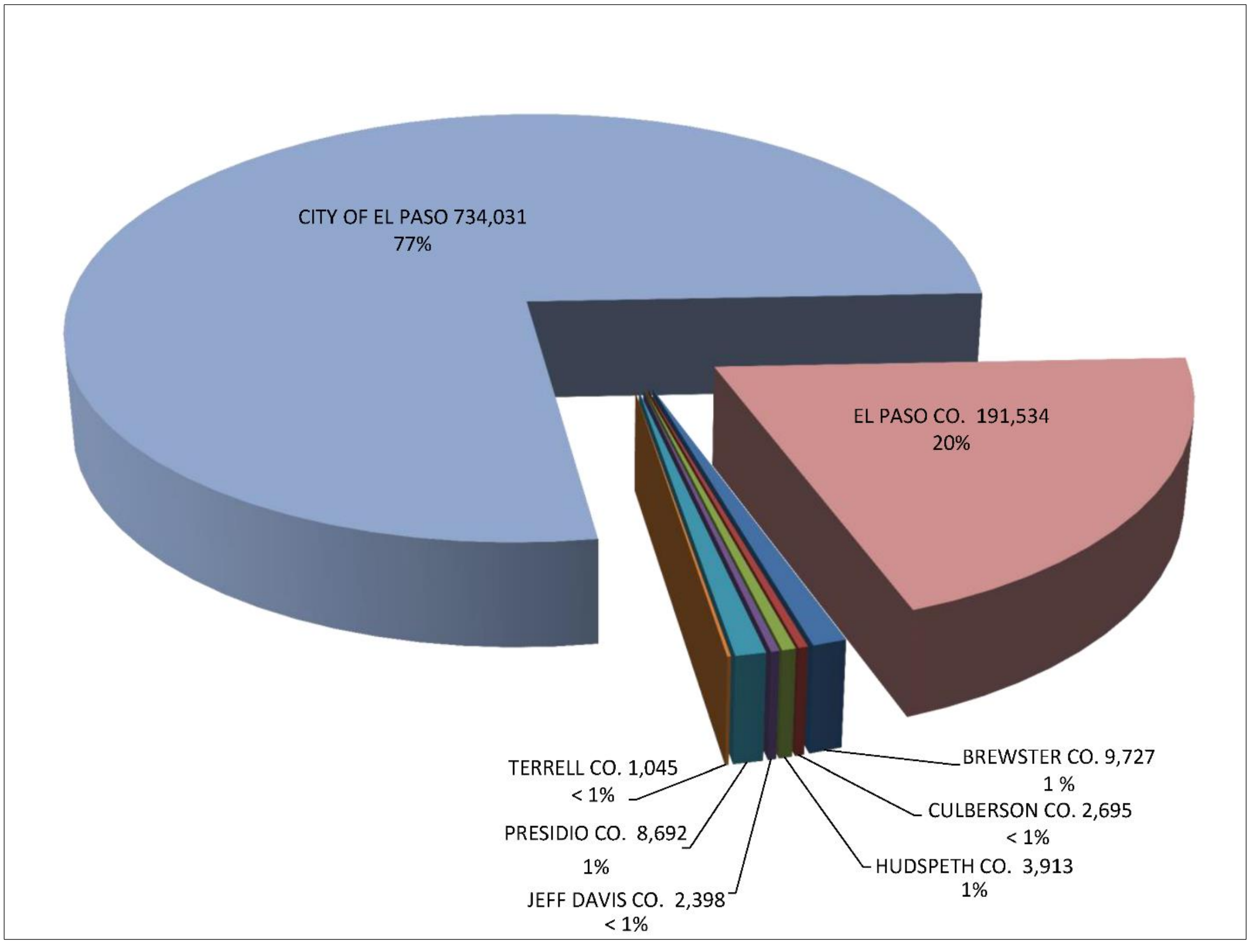

Figure 1-4. Year 2020 Projected Population

1.2.3 Land Use

Land use in the seven-county Region, as illustrated in Figure 1-5, is described here in terms of six categories:

- Urban (or developed)
- Cultivated agricultural
- Rangeland
- Forest
- Waterways and Wetlands
- Barren

Urban lands make up less than one percent of the total land area in Far West Texas. The largest concentration of urban land is in El Paso County, where 97 percent of the Region's residents live. Cultivated agricultural lands are identified as areas that support the cultivation of crops and occupy less than one percent of the total land area of the Region. These lands generally require access to high volumes of groundwater or surface water. Together, urban and cultivated agricultural lands comprise the two most significant water consumptive land-use areas.

Rangeland is defined as all areas that are either associated with or are suitable for livestock production. Although this is the largest category of land use in the Region, rangeland accounts for one of the smallest sources of water demand. Forestland occurs where topography and climate support the growth of native trees. These are limited to highlands, such as the Davis, Guadalupe and Chisos Mountains. Forestlands rely exclusively on rainfall as a source of moisture.

Areas designated as either water or wetlands are mostly associated with the Rio Grande and the Pecos River and their tributaries. The Rio Grande is also a major source of irrigation water for agricultural lands in El Paso, Hudspeth and Presidio Counties. Most all other streams in the Region are ephemeral. In addition to the two rivers, wetlands formed by desert springs (cienegas) provide critical wildlife habitat. Finally, barren lands are defined as undeveloped areas with little potential for use for agriculture, rangeland, or forests.

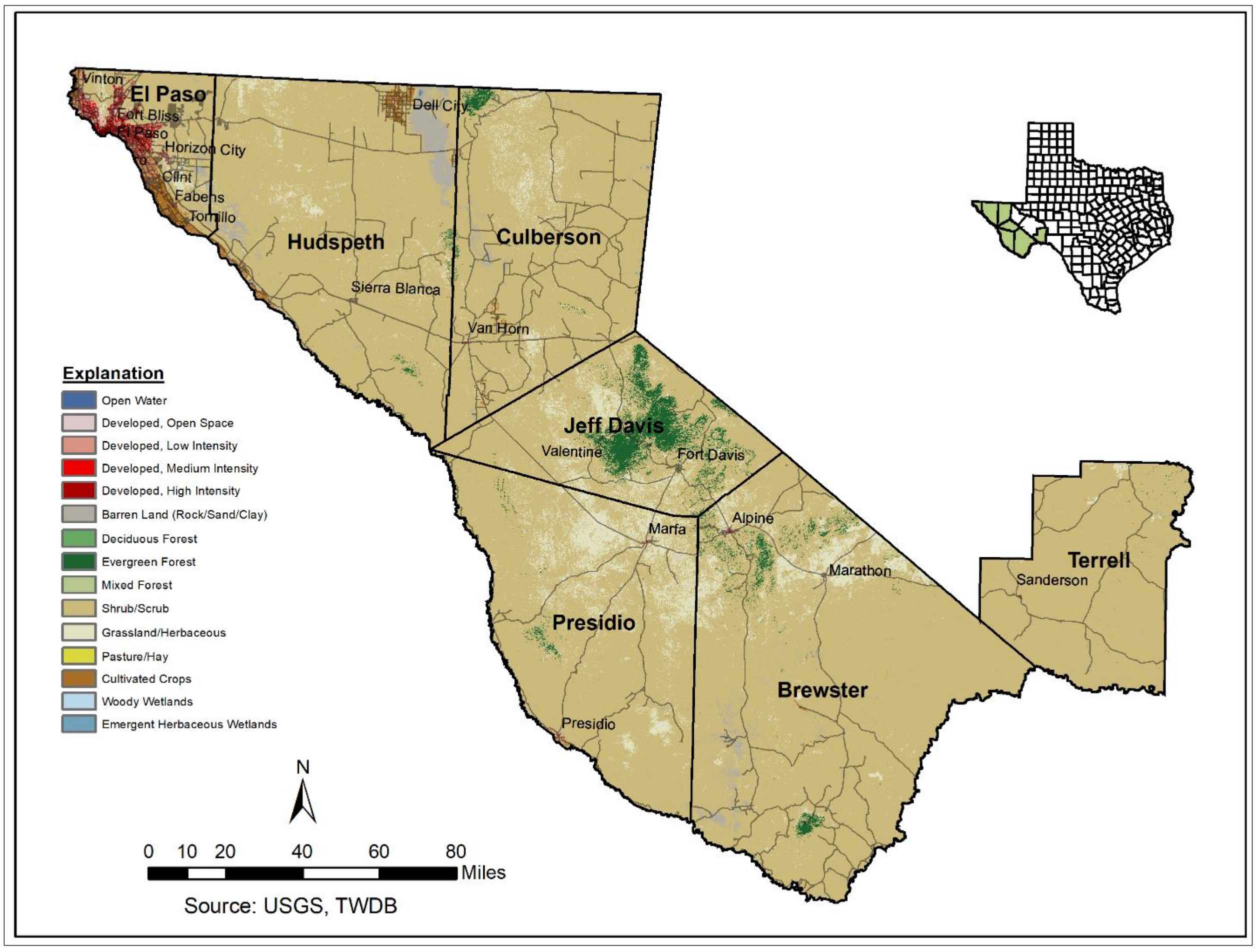

Figure 1-5. Land Use

1.2.4 Climate

Far West Texas, the most arid region in the State, is positioned in the northern part of the Chihuahuan Desert, a large arid zone that extends southward into Mexico. Only the highest altitudes occurring in the eastern part of the Region receive sufficient precipitation to be considered semiarid, rather than true desert.

The mean annual temperature of the Region is approximately 65°F. The average annual low temperature ranges between 45° F and 54° F, and the average high is 77°F to 80°F. During summer months, afternoon temperatures often exceed 100°F. In the winter, lows in the mountains and high desert plateaus can plummet to less than 10°F.

The Region usually reports the lowest annual precipitation (the regional average is 12.9 inches) and the highest lake-surface evaporation (the regional average is 70 inches) in Texas (Figure 1-6 and Figure 1-7). The combination of low rainfall and high evaporation creates what would be considered drought conditions in any other part of the State.

From highest to lowest values, average annual rainfall at selected locations is reported as follows:

- Mount Locke, Jeff Davis County (20.8 in)
- Alpine, Brewster County (16.9 in)
- Marfa, Presidio County (15.9 in)
- Sanderson, Terrell County (14.3 in.)
- Van Horn, Culberson County (13.1 in)
- Presidio, Presidio County (10.8 in)
- Hudspeth County (10 in)
- City of El Paso, El Paso County (8.8 in)

According to the National Climatic Data Center (NCDC), most rainfall occurs between the months of June and October, as indicated by a graph of average monthly rainfall for selected stations (Figure 1-8). Rainfall during the spring and summer months is dominated by widely scattered thunderstorms. Because of the convective nature of thunderstorms, the amount of spring and summer precipitation in the Region increases with elevation.

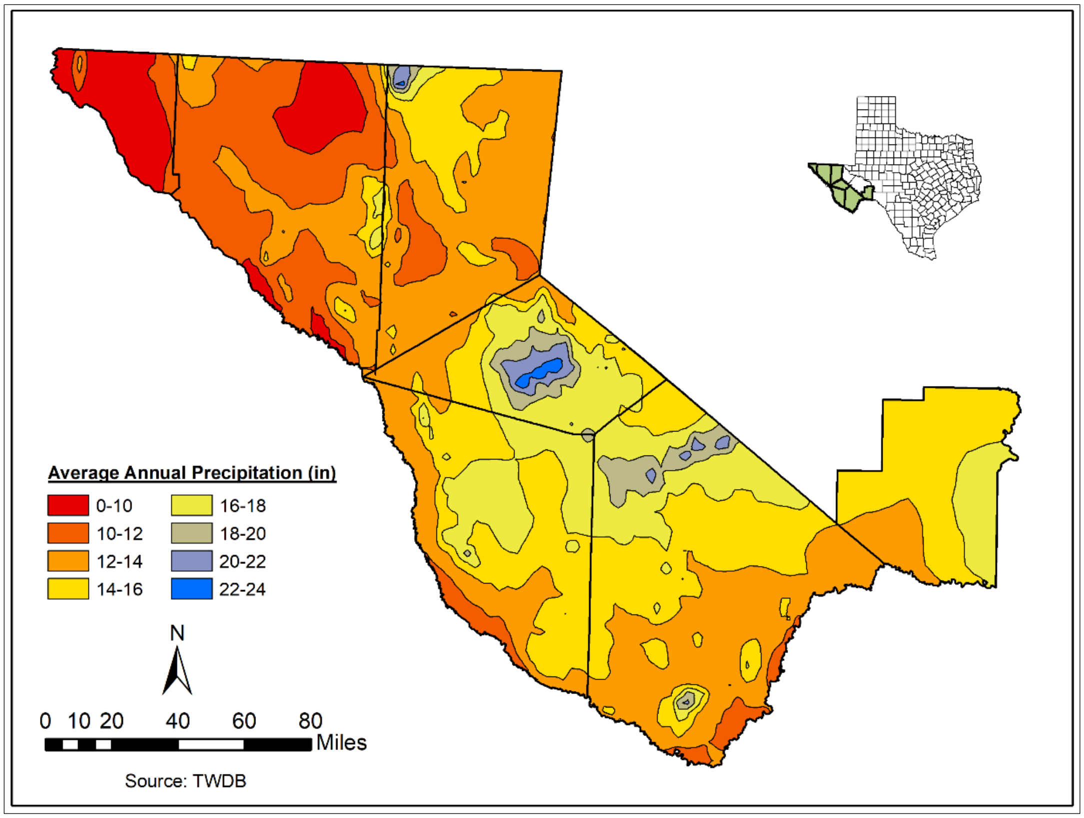

Figure 1-6. Variation of Precipitation

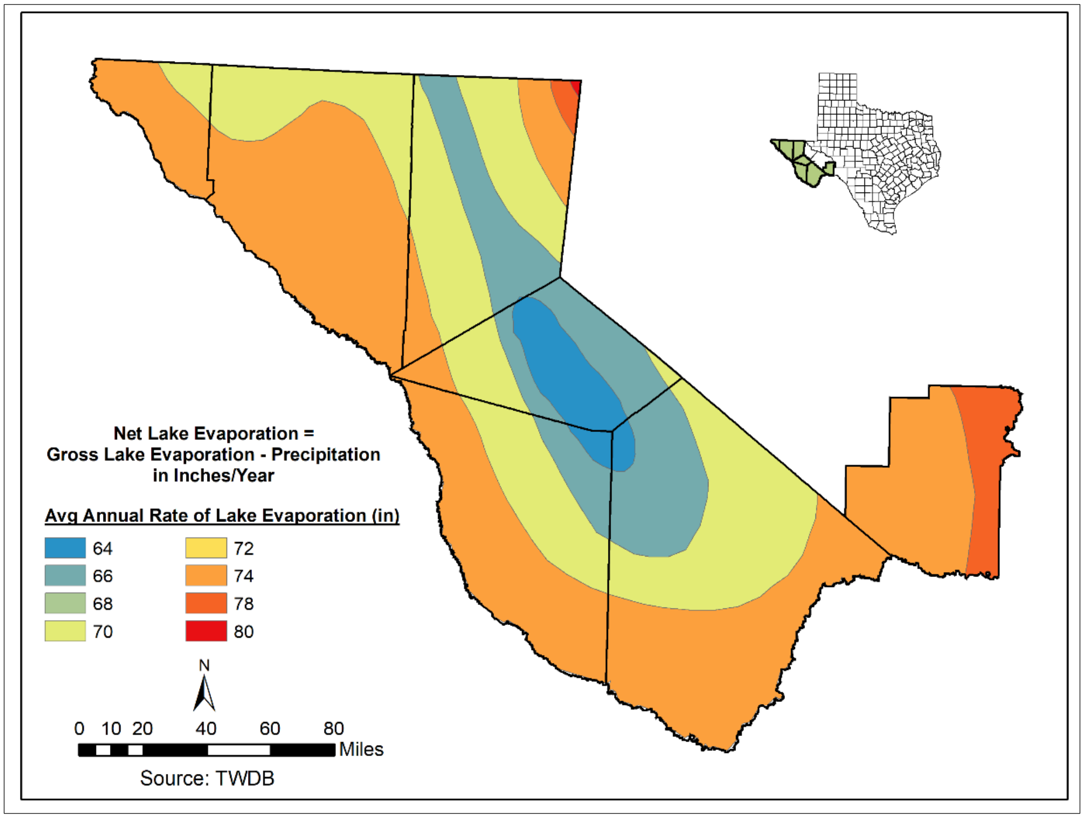

Figure 1-7. Net Lake Evaporation

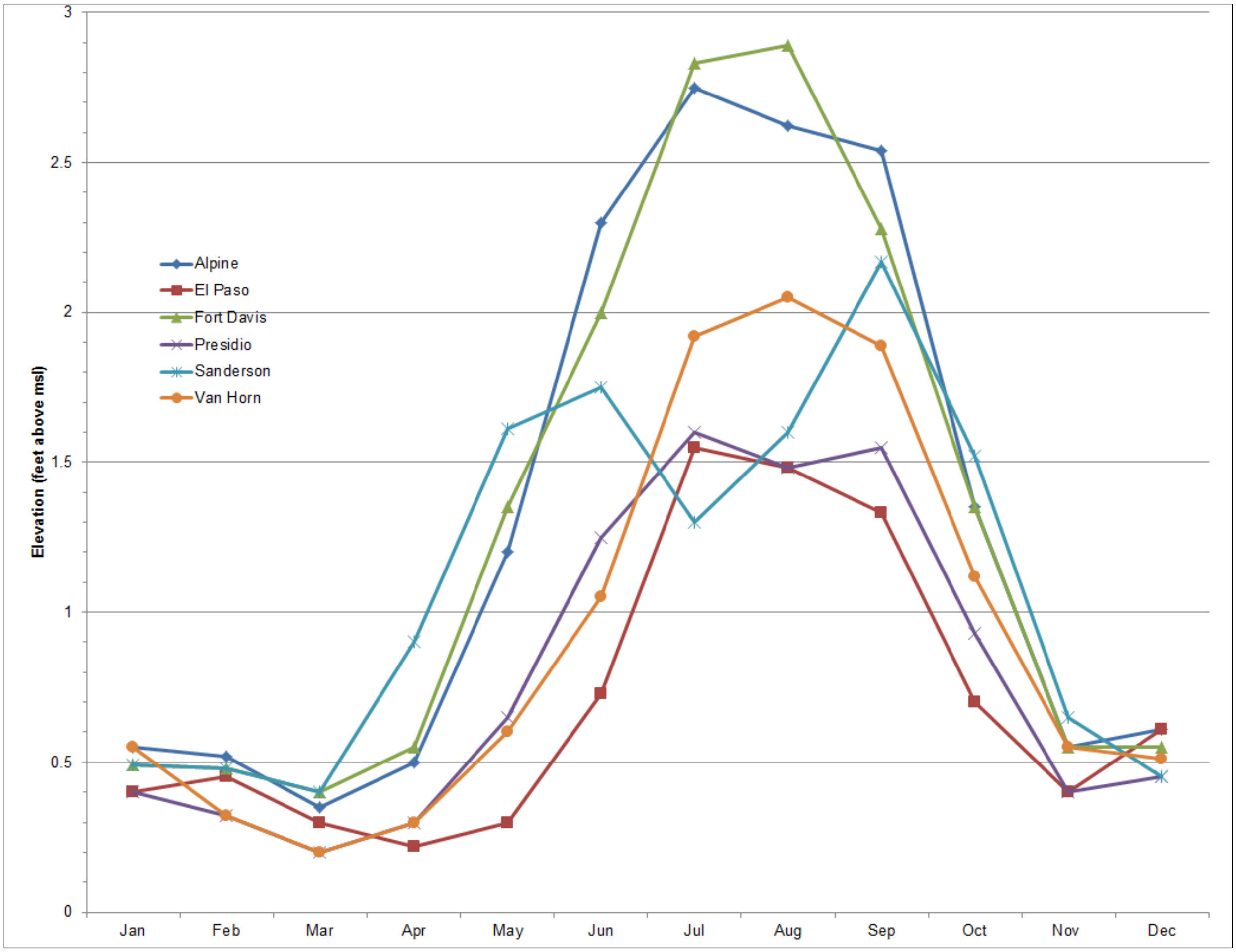

Figure 1-8. Average Monthly Rainfall
Source: NCDC

1.2.5 Far West Texas Climate Change Conference

Far West Texas, like much of the western United States, has historically relied on large-scale infrastructure to store and deliver surface water supplies. These surface water supplies are particularly vulnerable to changes in weather patterns. With the realization that the regional climate may have been more variable in the past than indicated by the historical record and may be even harsher and more variable in the future, several western states have taken on initiatives to address the potential impacts of climate change on their natural resources.

Because of these and other considerations, State Senator Eliot Shapleigh authored Senate Bill 1762 during the 80th Texas Legislative Session. The bill directed the Texas Water Development Board, in coordination with the FWTWPG, to conduct a study regarding the possible impact of climate change on surface water supplies from the portion of the Rio Grande in Texas subject to the Rio Grande Compact. Because of this legislation, the Texas Water Development Board hosted the Far West Texas Climate Change Conference June 17, 2008, at the Carlos M. Ramirez Water Resources Learning Center in El Paso. Along with other related issues, conference participants reviewed:

- Current analyses of potential impacts of climate change on surface water resources in Texas and other Western states; and
- Recommendations for incorporating potential impacts of climate change into the Far West Texas Water Plan, including potential impacts to the Rio Grande in Texas subject to the Rio Grande Compact, and identifying feasible water management strategies to offset any potential impacts.

The entire report "Far West Texas Climate Change Conference – Study Findings and Conference Proceedings" can be accessed at http://www.twdb.texas.gov/publications/reports/special_legislative_reports/doc/climatechange.pdf.

1.2.6 Drought

Drought conditions are assumed in the planning process to ensure that adequate infrastructure and planning is in place under severe water shortage conditions and is discussed in detail in Chapter 7 of this *Plan*. Drought in Far West Texas can be defined in the following operational definitions:

Meteorologic drought is an interval of time, usually over a period of months or years, during which precipitation cumulatively falls short of the expected supply.

Agricultural drought is that condition when rainfall and soil moisture are insufficient to support the healthy growth of crops and to prevent extreme crop stress. It may also be defined as a deficiency in the amount of precipitation required to support livestock and other farming or ranching operations.

Hydrologic drought is a long-term condition of abnormally dry weather that ultimately leads to the depletion of surface water and groundwater supplies, the drying up of lakes and reservoirs, and the reduction or cessation of springflow or streamflow.

Although agricultural drought and hydrologic drought are consequences of meteorologic drought, the occurrence of meteorologic drought does not guarantee that either one or both of the others will develop. Regarding the upper segment of the Rio Grande, drought is more significantly influenced by the amount of snowmelt in southern Colorado and northern New Mexico that affects the amount of water in storage in Elephant Butte Reservoir shown in Figure 1-9 (data provided by U.S Department of Interior, Bureau of Reclamation). For Far West Texas and particularly those who rely on the Rio Grande, an operational drought definition is more appropriate.

The westernmost part of Texas, as well as the headwaters of the Rio Grande in Colorado and New Mexico, has been experiencing drought conditions for much of the past two decades, with only 1997, 2005 and 2008 experiencing above average spring runoff into Elephant Butte reservoir. According to the U.S. Bureau of Reclamation El Paso Office, July 2013 Elephant Butte reservoir was at only three percent of capacity. 2013 was the shortest irrigation season (less than six weeks) and supplied the least amount of water in the almost 100-year history of the Rio Grande Project. After a short period of recovery, the reservoir was again back down to 3.3 percent of capacity by October 2018. Per the TWDB Water Data for Texas (http://www.waterdatafortexas.org/), in April 2019 Elephant Butte Reservoir is 14 percent of a full reservoir. Approximately one-fourth of the water currently in storage is Rio Grande Compact Credit water, which is owned by upstream users and is not available for use in southern New Mexico, Texas, or Mexico.

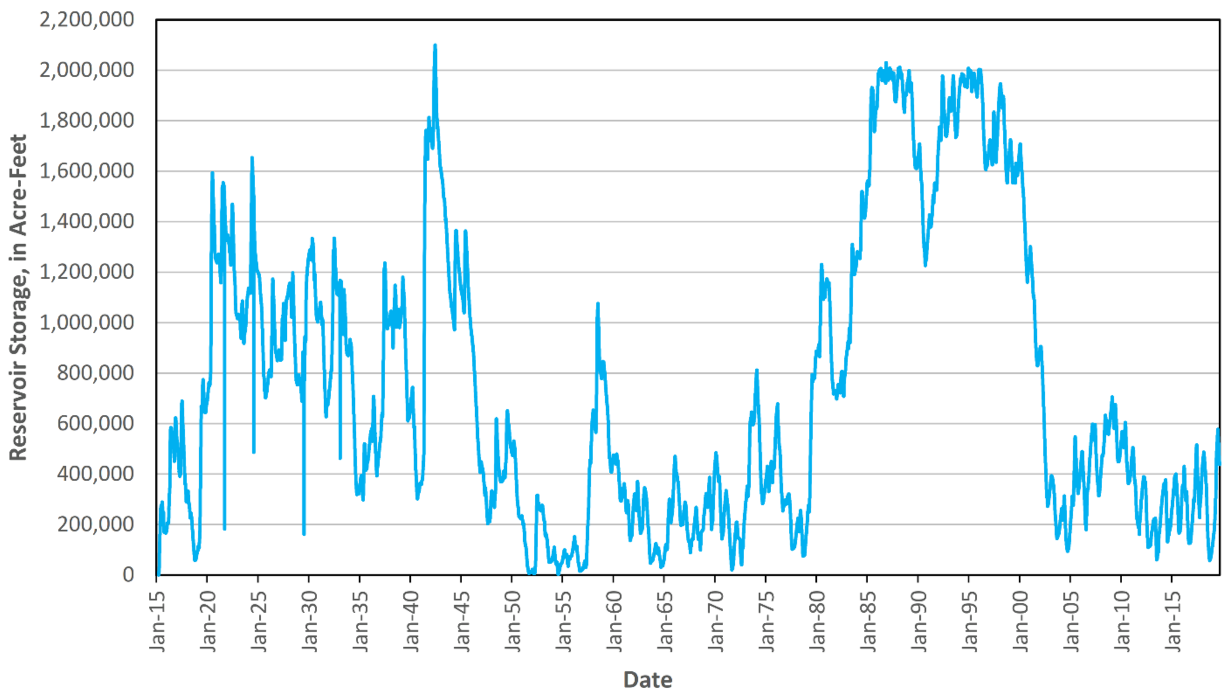

Figure 1-9. Elephant Butte Reservoir
Source: U.S. Bureau of Reclamation

River drought above Fort Quitman is a period when the Rio Grande and its storage facilities (reservoirs) have reached a stage where water deliveries are less than full allocation. There may be a drought in all other definitions, but if there is adequate storage in the local reservoir (Elephant Butte), there is no "river drought" and no reduction in surface water deliveries.

River drought below confluence of Rio Conchos may be defined as any time the combined flows of the Rio Grande and Rio Conchos falls below 250 cubic feet per second (cfs) for more than 90 consecutive days.

Consistent flows of less than 250 cfs below Presidio have reduced to bare remnants an agricultural economy on land that has been continuously cultivated longer than anywhere else in Texas. Consistent low water flow threatens important wildlife habitat and river recreation resources that are essential building blocks for rural economies downstream of El Paso.

The 1950s Drought of Record (DOR) and the current drought can be compared using historic precipitation, stream flow records, spring discharges and water level measurements in wells for locations that have accumulated data measurements since the 1940s. This is discussed further in Chapter 7. For this planning cycle, the drought of the 1950s is declared the DOR. However, it is the intent of the current *2021 Plan*, to illustrate in Chapter 7 that although the 1950s drought is the historic Drought of Record, drought conditions experienced over the past decade are significant. Although it is impossible to determine whether the current drought will become the new DOR, further evaluations will be made in future planning cycles to continuously assess the Region's drought conditions.

Far West Texas is perennially under drought or near-drought conditions compared with more humid areas of Texas. Although residents of the Region are generally accustomed to these conditions, the low rainfall and the accompanying high levels of evaporation underscore the necessity of developing plans that respond to potential disruptions in the supply of groundwater and surface water caused by drought conditions. Those entities that rely on surface water are most vulnerable to the impact of drought. Irrigators along the Rio Grande rely on projected allocations provided by the U.S. Bureau of Reclamation to anticipate their crop potential each year. El Paso Water has developed a conjunctive use plan in which it can shift supply emphasis to groundwater sources during periods of low surface water availability. Water management and drought contingency plans for regional entities are discussed in detail in Chapter 7.

1.2.7 Native Vegetation and Ecology

Vegetation native to the arid Chihuahuan Desert is closely tied to the Region's precipitation and evaporation potential. This area typically receives most of its precipitation in the summer in the form of convective storms, which are typically characterized by intense rainfall concentrated in small areas. When it occurs, winter precipitation comes from frontal systems, which are generally soaking rains covering larger areas. Due to their nature, the summer precipitation generally wets only the shallow subsurface soil layer, whereas, winter rains are more likely to percolate deeper into the subsurface.

According to the Chihuahuan Desert Research Institute, vegetation native to Far West Texas can be classified into two groups, intensive water users and extensive water users. Intensive water users include short grasses and cacti, which have short root systems and respond quickly to small amounts of moisture that is available in the soil profile for only a limited time. Extensive water users have both shallow roots capable of capturing soil moisture as well as deep roots that penetrate further downward in the subsurface. Thus, summer rainfall favors grasslands, while winter rainfall favors scrubs. Although a shift in predominate precipitation patterns from summer to winter has not been clearly recognized, local observations indicate that scrubs are becoming more predominate. Likewise, it is becoming increasingly clear that ongoing drought conditions in Far West Texas are placing a serious strain on vegetation, especially the oak and conifer woodlands in the higher elevations.

1.2.8 Agricultural Resources

Agriculture, including both the beef industry and irrigated farming, is the most significant economic activity in Far West Texas. The raising of beef cattle occurs in all seven counties, with Brewster County accounting for the greatest number of range cattle. The dairy industry primarily occurs in El Paso County.

With an average annual rainfall of less than 13 inches, the raising of crops in this Region requires irrigation. Most irrigated farming occurs along the flood plains of the Rio Grande in El Paso, Hudspeth, and Presidio Counties, where water is diverted from the River to grow vegetables, cotton, various grain crops, and orchards. Inland, groundwater sources are pumped to the surface to irrigate crops and pastures primarily in Hudspeth (Dell Valley), Culberson (Diablo Farms, Wild Horse Flat, and Lobo Flat), and Jeff Davis (Ryan Flat and Lobo Flat) Counties.

Agricultural activities in the Region that rely on surface water are designed to accommodate the intermittent nature of the supply. In some cases, this means that agricultural water supply needs will be supplemented by groundwater sources, or that irrigation activities will cease until river supplies are replenished.

The only potential impacts to agricultural are identified with the possible change in water rights use from agricultural use to municipal use of Rio Grande water in El Paso County and groundwater in the Dell City and Diablo Farms areas of Hudspeth and Culberson Counties. As these strategies only potentially change the use of the water and not the volume of diversion, there is no significant impact to natural resources.

1.2.9 Natural Resources

Far West Texas boasts the highest and most scenic desert communities in Texas. The natural resources of the Region include the surface water and groundwater sources described in Sections 1.4 and 1.5 of this chapter, and in Chapter 3. Terrestrial and aquatic habitats that provide beautiful vistas, recreational opportunities, and unique wildlife habitats are also natural resources. Understandably, both residents and tourists make use of these resources in their enjoyment of the numerous public parks within the Region. Big Bend National Park, Guadalupe Mountains National Park, and Big Bend Ranch State Park are three of the largest protected areas in the Region.

Natural resources also include the great diversity of plant and animal wildlife that inhabit these environments. Texas Parks and Wildlife Department's Natural Diversity Database is a comprehensive source of information on species by county that are federally listed, proposed to be federally listed, have federal candidate status, are state listed, or carry a global conservation status indicating a species is critically imperiled, very rare, vulnerable to extirpation, or uncommon. TPWD suggests that due to continuing updates that readers access the most current listing at http://www.tpwd.state.tx.us/landwater/land/maps/gis/ris/endangered_species.

Both plant and animal species endemic to Far West Texas have developed a tolerance for the intermittent nature of surface water availability; however, significantly long drought conditions can have a severe effect on these species. Riparian water needs for birding habitat are particularly critical. Springs (Cienegas) emanating from shallow groundwater sources often provide the most constant water supply available for aquatic habitat. "Major Springs" in the Region are listed in Section 1.6 of this chapter and are described in more detail in Appendix 1E of the *2011 Far West Texas Water Plan*, while "ecologically unique river and stream segments" are described in Chapter 8 of this *2021 Plan*.

Of recognized importance to the water planning process is the concern of the effect that future development of water supplies might have on the diversity of species in the Region. Water-supply deficit strategies developed in Chapter 5 of this *Plan* include an evaluation of each strategy's potential impact on the environment and natural resources.

1.3 REGIONAL WATER DEMAND

1.3.1 Major Demand Centers

Total projected year-2020 water consumptive use in Far West Texas is 480,424 acre-feet. The largest category of use is irrigation (310,403 acre-feet), followed by municipalities and county-other (142,507 acre-feet), manufacturing (7,033 acre-feet), steam-electric cooling (10,545 acre-feet), mining (7,835 acre-feet), and livestock (2,101 acre-feet) (Figure 1-10). Sixty-five percent of water used in the Region is by the agricultural sector in support of irrigation. Thirty percent is used by municipalities and county-other, and the remaining 5 percent supports manufacturing, steam-electric power generation, livestock, and mining. Current and projected water demand for all water-use types are discussed in detail in Chapter 2.

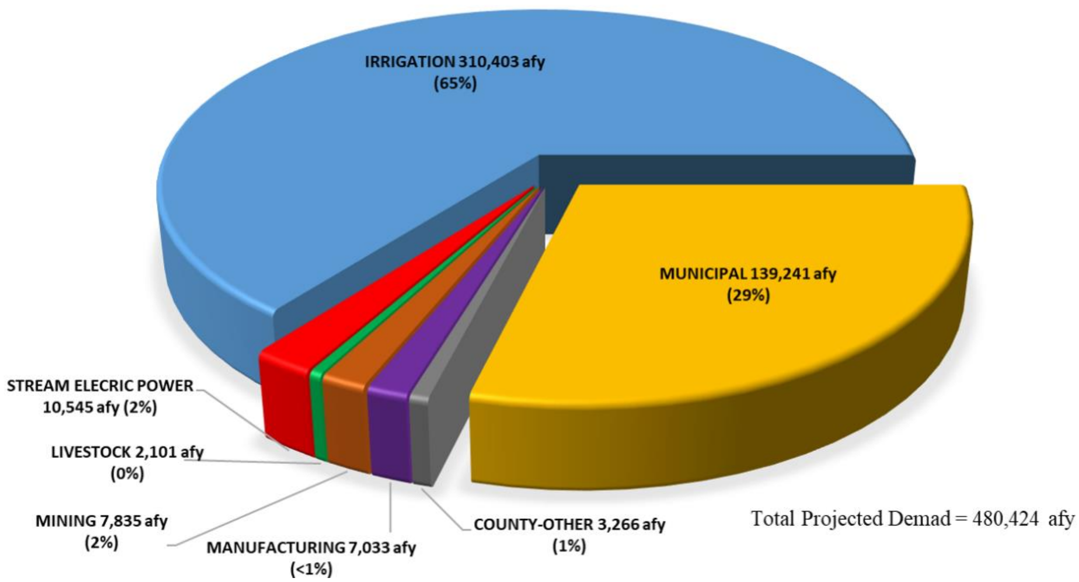

Figure 1-10. Year 2020 Projected Water Demand by Water-Use Category

1.3.2 Agriculture

The cultural and physical landscape of Far West Texas has more in common with the desert southwest than with other areas of Texas. The dominant commercial land use throughout the rural areas of the Region is extensive cattle grazing. Aridity and historic land-tenure practices have combined to produce large ranches and low animal densities. The projected total volume of water used in livestock production in the Region in the year 2020 is 2,101 acre-feet. Livestock water demand in 2020 ranges from a high of 437 acre-feet in Hudspeth County to a low of 151 acre-feet in Terrell County. The reduction of concentrated dairy farms has significantly reduced livestock water consumption in El Paso County. Cow and calf operations dominate the livestock industry in every county except Terrell, where sheep and goats predominate. In addition to livestock, many of the ranches supplement revenue through hunting leases.

There is virtually no rain-fed agriculture (dry-land farming) in Far West Texas, and even irrigated agriculture is confined to a small fraction of the Region. Floodplain-irrigated agriculture is found along the Rio Grande extending above and below El Paso (EPCWID#1) and into southern Hudspeth County

(HCCRD#1). A much smaller irrigated strip also occurs along the Rio Grande near Presidio from Candelaria to Redford.

Currently, irrigated agriculture based on groundwater pumping is essentially limited to Dell Valley in northeastern Hudspeth County, Diablo Farms in northwestern Culberson County, and Wild Horse and Lobo Flats near Van Horn. High quality cotton, pecans, alfalfa, and vegetables such as tomatoes, onions, and chilies are the major crops of the Region.

Total projected irrigation use in the Region in the year 2020 is 310,403 acre-feet. El Paso and Hudspeth Counties accounted for the greatest amount of irrigation with 149,570 and 115,542 acre-feet of use, respectively. Along the Rio Grande corridor in these two counties, irrigation water is diverted from the River, except during years when flow is significantly below normal. In northeastern Hudspeth County, the Dell Valley farming area irrigates cropland with groundwater pumped from the underlying Bone Spring-Victorio Peak Aquifer.

Irrigation in El Paso and Hudspeth Counties represents 85 percent of total irrigation water use in the Region. Most of the remaining 15 percent of irrigation demand is centered in Culberson County, where 37,863 acre-feet is projected to be used in 2020 to support irrigated agriculture. Greenhouse farming operations near Fort Davis and Marfa have the highest crop (tomatoes) yield per volume of water applied.

The area of land irrigated in the El Paso County Water Improvement District #1 in any given year varies from 40,000 to 50,000 acres. The total water rights acreage in the District, however, is 69,010. The City of El Paso currently owns or leases 13,075 acres of land within the District with water rights.

Crop production in Far West Texas is not sustainable without a source of irrigation water. A reduction in the quantity of water available for irrigation will cause a reduction in the number of acres that can be irrigated profitably. Similarly, cutbacks in the supply of water for livestock will cause a reduction in herd size. As water supplies are depleted, modifications will be required to use the available rangeland resource, and water hauling within a given ranch may be required to better distribute water to livestock.

Although drought-like conditions are a relative constant in the Region, extended periods of below-normal rainfall can have significant and long-lasting harmful effects on the rangeland resource. Reduction of livestock numbers because of drought usually lags the impact of drought on the range-grass ecosystem. Extended periods of drought can lead to the depletion of grass species and to an increase in shrub species. This leads to a decrease in soil cover and increases the potential for erosion by water and wind.

A decrease in water quality has a greater impact on crop production than on livestock output. As the salinity of irrigation water increases, the amount of irrigation water applied must also increase. This satisfies the leaching requirement and keeps the root zone salinity at levels that allow for economic crop production. If salinity levels increase, the mixture of crops may change to include crops with greater tolerance to soil salinity.

Groundwater use for irrigated farming principally occurs in Dell Valley, Diablo Farms, and along the various flats that comprise the Salt Basin bolson valley. Principal aquifers from which irrigation water is withdrawn include the Rio Grande Alluvium, Bone Spring-Victorio Peak, Capitan Reef, and the Wild Horse/Michigan, Lobo, and Ryan Flats of the West Texas Bolson Aquifers. Characteristics of these aquifers are described in Chapter 3.

Future availability of water for agricultural use from these aquifers varies. During times of insufficient river flow farmers may use groundwater from the Rio Grande Alluvium to sustain crops. However, because of its high mineral content, this water can only be used on a short-term basis. In Dell Valley, groundwater from the Bone Spring-Victorio Peak Aquifer has deteriorated in quality particularly in the central part of the valley as a result of repeated irrigation water return flow. The aquifer should remain viable in the future as the Hudspeth County Underground Water District #1 limits permitted withdrawals to 101,400 acre-feet or less annually (MAG aquifer limit). Water levels have declined in the past in most parts of the Salt Basin aquifers but have generally recovered due to a decrease in pumpage in recent years.

1.3.3 Municipal and County-Other

The municipal and county-other category of demand consists of both urban residential, rural-domestic, and commercial water uses. Commercial water consumption includes business establishments, public offices, and institutions, but does not include industrial water use. Residential and commercial uses are categorized together because they are similar types of uses, i.e.; they both use water primarily for drinking, cleaning, sanitation, air conditioning, and landscape watering. Total projected municipal and county-other water demand in the seven counties in the year 2020 is projected to be 142,507 acre-feet.

The City of El Paso, with a projected water use of 110,572 acre-feet in the year 2020, represents 78 percent of the total municipal and county-other water use in the Region. The City's water demand has remained in check over the last several years due to diligent enforcement of conservation measures. Total projected municipal and county-other water use in El Paso County (136,508 acre-feet in 2020), which includes the City of El Paso, other communities, and rural domestic supply, represents 96 percent of the Regional total.

El Paso Water (EPW), which serves the City of El Paso, obtains approximately half of its water from the Rio Grande in full river water supply allocation conditions. The remainder is groundwater pumped from wellfields in the Mesilla Bolson and Hueco Bolson Aquifers. The Utility also supplies water to other incorporated areas and to businesses within El Paso County. Other entities in El Paso County not served by EPW rely exclusively on groundwater resources. All the cities and unincorporated areas of the six rural counties likewise depend entirely on groundwater resources from aquifers located in their respective areas.

Following necessary treatment, water supplies developed for municipal consumption are expected to meet "primary" and "secondary" safe drinking-water standards mandated by the U.S. Environmental Protection Agency and the Texas Commission on Environmental Quality. "Primary standards" address dissolved particulates (e.g., heavy metals and organic contaminants) that are known to have adverse effects on human health. "Secondary standards" address factors that affect the aesthetic quality (e.g., taste and odor) of drinking water.

Water quality varies widely within the Region. In much of the rural counties, groundwater is of sufficient quality that only chlorination is required as a means of treatment. In other areas, various methods of treatment are required to bring the water into compliance with primary and secondary standards. For example, Dell City, El Paso, and Horizon Regional MUD operate desalination plants or wellhead facilities to reduce the concentration of total dissolved solids (TDS) in groundwater extracted from local aquifers.

El Paso Water (EPW) actively treats available water supplies to meet drinking-water standards. These operations include the blending of fresh water with marginally elevated TDS water to increase available supplies, and the tertiary treatment of wastewater to generate supplies for reuse. EPW has updated its treatment facilities to accommodate the recently lowered arsenic concentration standard. EPW and Fort Bliss have jointly constructed the Kay Bailey Hutchison Desalination Facility, a 27.5 MGD desalination plant that makes use of brackish groundwater in the Hueco Bolson Aquifer, thus preserving fresh water in the aquifer for drought protection and emergency use.

County-other is an aggregation of residential, commercial, and institutional water users in cities with less than 500 people or non-city utilities that provide less than an average of 250,000 gallons per day, as well as unincorporated rural areas in each county. The 2020 county-other total water demand for the Region is 3,266 acre-feet/year (Figure 1-10).

1.3.4 Major Water Providers

A major water provider is defined as a significant public or private WUG or wholesale water provider (WWP) whose significance is determined by the RWPG and provides water for any water use category in a regional water planning area. Entities meeting this definition and entities to which they contract are as follows:

El Paso County Water Improvement District #1

- El Paso Water

El Paso Water

- City of El Paso
- Lower Valley Water District
- Fort Bliss
- Vinton Hills
- Paseo Del Este MUD#1
- East Montana Water System
- Haciendas Del Norte WID
- County Other
- El Paso Steam Electric
- Manufacturing
- Mining

Lower Valley Water District

- Socorro
- San Elizario
- Clint

Horizon Regional MUD

- Horizon City
- County Other

The El Paso County Water Improvement District #1 primarily delivers water from the Rio Grande to irrigators in El Paso County and sells water to El Paso Water (EPW). EPW obtains raw surface water from the El Paso County Water Improvement District #1 and groundwater from its own wells in the Hueco and Mesilla Bolson Aquifers. While most of this water is used within the City of El Paso, significant volumes are also provided to manufacturing and power generating entities, as well as other public suppliers outside of the city. The Lower Valley Water District is a significant supplier of water to Socorro, San Elizario, Clint, and other retail customers and receives all its supply from EPW. Horizon Regional MUD supplies water to Horizon City and other local retail customers.

1.3.5 Industrial, Manufacturing, Electric Power Generation, and Mining

Industrial and manufacturing companies, which represent a significant component of the economy of Far West Texas, are mostly located in El Paso County where all but 56 acre-feet of the total 7,033 acre-feet of water projected to be used in the Region in the year 2020 is used in El Paso County. The industrial, manufacturing and power generation sectors purchase water from EPW, or are self-supplied by water wells. In some cases, companies use treated wastewater provided by EPW through the Utility's purple-pipe program.

El Paso Electric Company located in El Paso County is the only facility within the Region that uses water in the form of steam to generate electricity (10,545 acre-feet in 2020). Anticipated local population growth, as well as increasing commercial and manufacturing power needs, means that the quantity of water needed to produce electricity will likewise increase. El Paso Electric currently purchases most of its water supply from EPW.

Chemical quality standards for water used for industrial purposes vary greatly with the type of industry utilizing the water. The primary concern with many industries is that the water does not contain constituents that are corrosive or scale forming. Also of concern are those minerals that affect color, odor, and taste; therefore, water with a high concentration of dissolved solids is avoided in many manufacturing processes.

The mining sector accounts for the smallest area of demand, with 7,835 acre-feet of projected total use in the Region in 2020.

1.3.6 Environmental and Recreational Water Needs

Environmental and recreational water use in Far West Texas is recognized as being an important consideration as it relates to the natural community in which the residents of this Region share and appreciate. In addition, for rural counties, tourism activities based on natural resources offer perhaps the best hope for modest economic growth to areas that have seen a long decline in traditional economic activities such as agriculture and mining.

Natural and environmental resources are often overlooked when considering the consequences of prolonged drought conditions. All living organisms require water. The amount and quality of water required to maintain a viable population, whether it be plant or animal, is highly variable. As water supplies diminish during drought periods, the balance between both human and environmental water requirements becomes increasingly competitive. A goal of this *Plan* is to provide for the health, safety, and welfare of the human community, with as little detrimental effect to the environment as possible. To accomplish this goal, the evaluation of strategies to meet future water needs includes a distinct consideration of the impact that each implemented strategy might have on the environment.

Recreation activities involve human interaction with the outdoor environment. Many of these activities are directly dependent on water resources such as fishing, swimming, and boating; while a healthy environment enhances many others, such as hiking and bird watching. Thus, it is recognized that the maintenance of the regional environmental community's water supply needs serves to enhance the lives of citizens of Far West Texas as well as the tens of thousands of annual visitors to this Region. Environmental and recreational water needs are further discussed throughout the *Plan*.

1.4 SURFACE WATER SUPPLY SOURCES

1.4.1 Rio Grande

The Rio Grande originates in southwestern Colorado and northern New Mexico, where it derives its headwaters from snowmelt in the Rocky Mountains (Figure 1-11). The Elephant Butte Dam and Reservoir in New Mexico is approximately 125 miles north of El Paso and can store over two million acre-feet of water. Water in the reservoir is stored to meet irrigation demands in the Rincon, Mesilla, El Paso, and Juarez Valleys and is released in a pattern for power generation. Above El Paso, flow in the River is largely controlled by releases from Caballo Reservoir located below Elephant Butte; while downstream from El Paso to Fort Quitman, flow consists of treated municipal wastewater from El Paso, untreated municipal wastewater from Juarez, and irrigation return flow. Below the El Paso-Hudspeth County line, flow consists mostly of return flow and occasional floodwater and runoff from adjacent areas. Channel losses are significant enough that the Rio Grande is often dry from below Fort Quitman to the confluence with the Mexican river, the Rio Conchos, upstream of Presidio. The Rio Conchos is the only significant perennial tributary in the 350 miles between Elephant Butte Reservoir and Presidio.

The Rio Grande is unique in its complexity of distribution management. Because the waters of the River must be shared between three U.S. states and the nation of Mexico, a system of federal, state and local programs has been developed to oversee the equitable distribution of water. The compacts, treaties and projects that currently provide the River's management framework are discussed in Chapter 3.

1.4.2 Pecos River

The Pecos River forms the eastern boundary of Far West Texas only for a short distance at the northeast corner of Terrell County (Figure 1-11). As a major tributary to the Rio Grande, the headwaters of the Pecos River originate as snowmelt east of Santa Fe, New Mexico in the Sangre de Cristo Mountains. The River flows southward through eastern New Mexico, where Red Bluff Lake impounds it at the Texas-New Mexico border. The Pecos River Compact provides the apportionment and division of Pecos River waters between New Mexico and Texas and is administered by the Pecos River Compact Commission. Although Pecos River water is typically too salty for human consumption, it has been a source for irrigation in Pecos, Reeves and Ward Counties. Downstream in Terrell County, water in the Pecos is mostly relegated to livestock use.

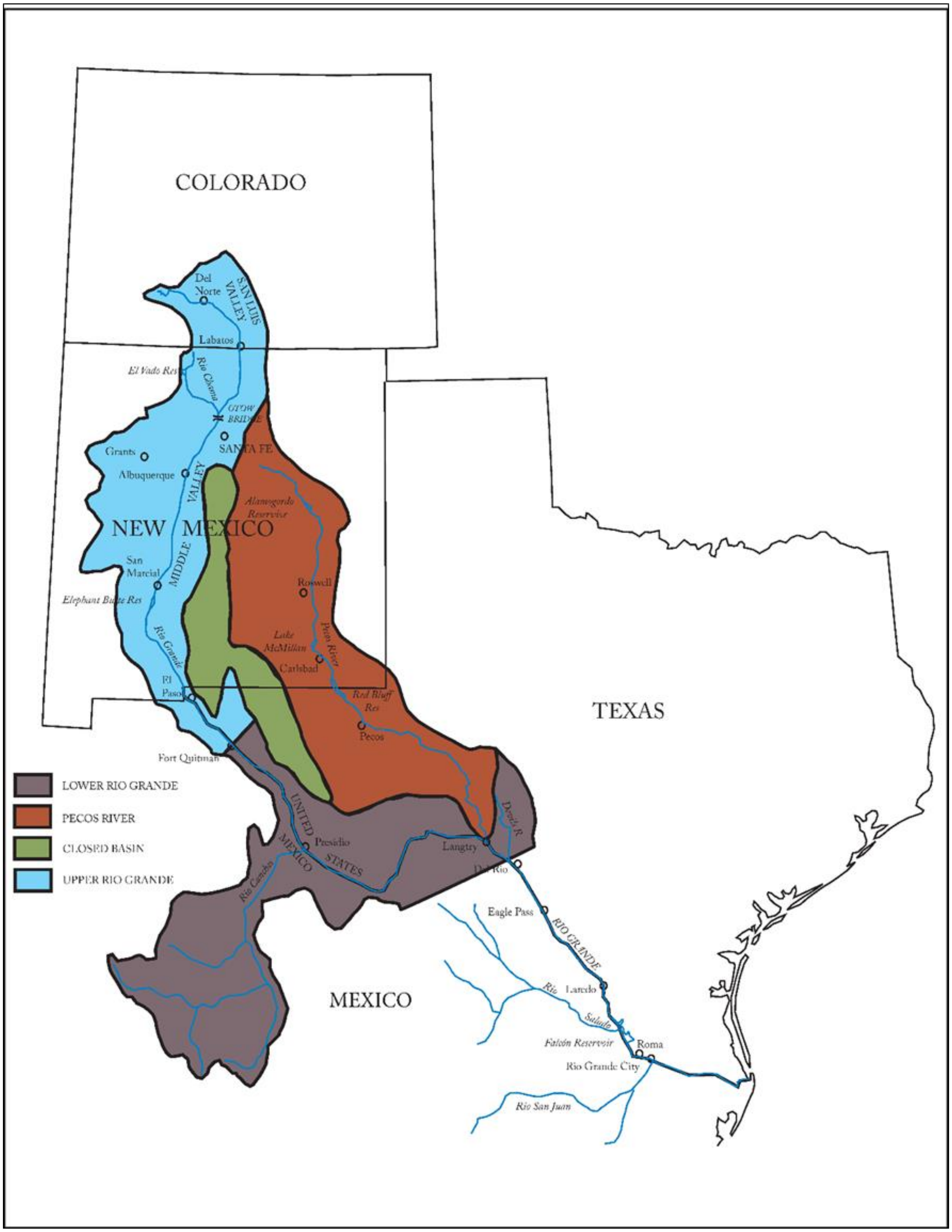

Figure 1-11. Rio Grande and Pecos River
(USGS Professional Paper 372-D)

1.4.3 Ecologically Unique River and Stream Segments

As a part of the planning process, regional planning groups may include recommendations of ecologically unique river and stream segments in their adopted regional water plans (31 TAC 357.8). The Texas Legislature may designate a river or stream segment of unique ecological value following the recommendations of a regional water planning group. As per §16.051(f) of the Texas Water Code, this designation solely means that a state agency or political subdivision of the State may not finance the actual construction of a reservoir in a specific river or stream segment designated by the legislature under this subsection.

The FWTWPG chooses to respect the privacy of private lands and therefore recommends as "Ecologically Unique River and Stream Segments" (Figure 1-12) three streams that lie within the boundaries of state-managed properties, four within National Park boundaries, and specified streams managed by the Texas Nature Conservancy and the Trans Pecos Water Trust. These stream and river segments are described in Chapter 8.

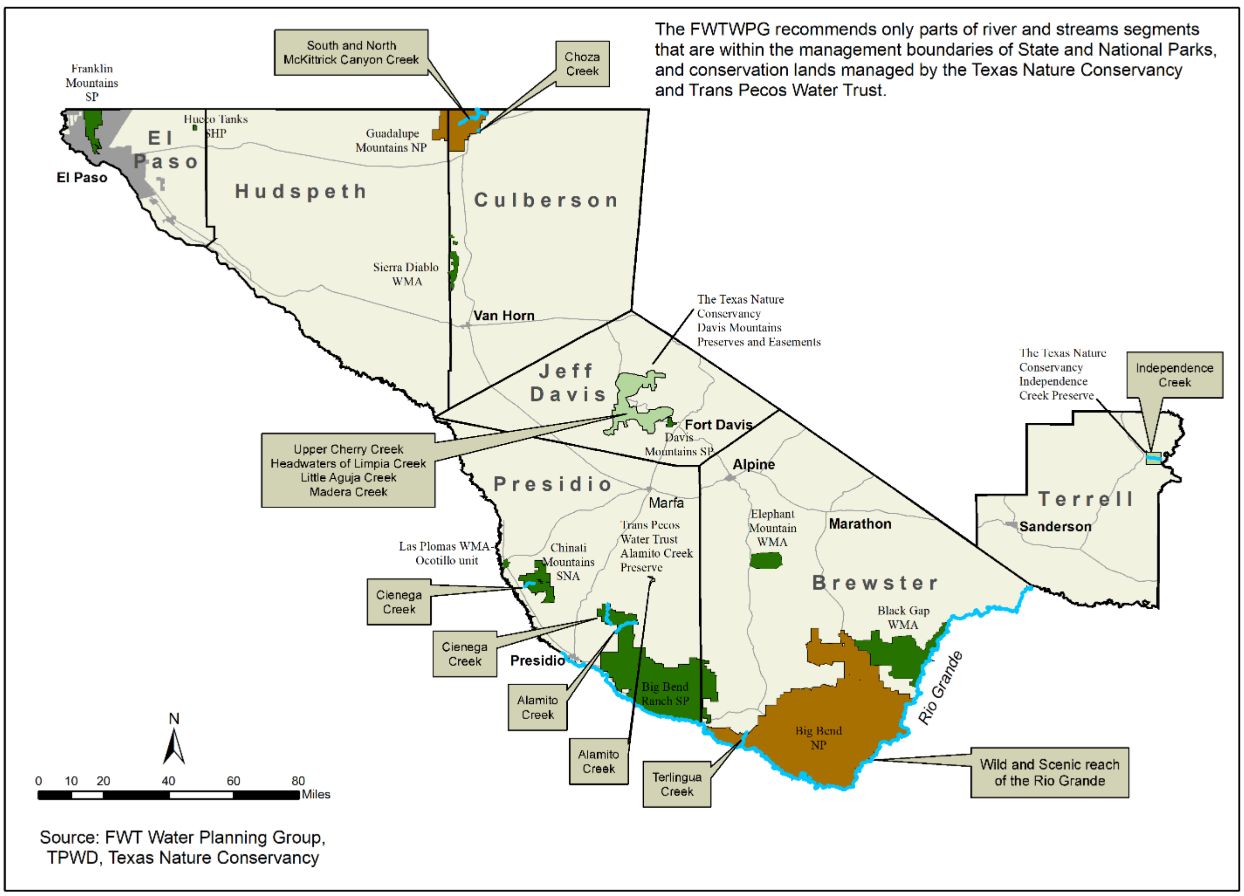

Figure 1-12. Recommended Ecologically Unique River and Stream Segments

1.5 GROUNDWATER SUPPLY SOURCES

Outside of the Rio Grande corridor, almost all water supply needs are met with groundwater withdrawn from numerous aquifers in the Region (Figure 1-13). Depth to water, well yields, and chemical quality dictate how these resources are used. A more thorough discussion of the aquifers, especially as it relates to water supply availability, can be found in Chapter 3. Aquifers recognized in the Region include the following:

- Hueco and Mesilla Bolson
- West Texas Bolsons
    - Salt Basin
        - Upper Salt Basin
        - Wild Horse and Michigan Flats
        - Lobo Flat
        - Ryan Flat
    - Presidio / Redford
    - Green River Valley
    - Red Light Draw
    - Eagle Flat
- Bone Spring-Victorio Peak
- Igneous (Davis Mountains Igneous)
- Edwards-Trinity (Plateau)
- Capitan Reef Complex
- Marathon
- Rustler
- Pecos Valley (Balmorhea Alluvium)

Other locally recognized groundwater sources:

- Rio Grande Alluvium
- Edwards-Trinity of Brewster County (Brewster Cretaceous)
- Diablo Plateau

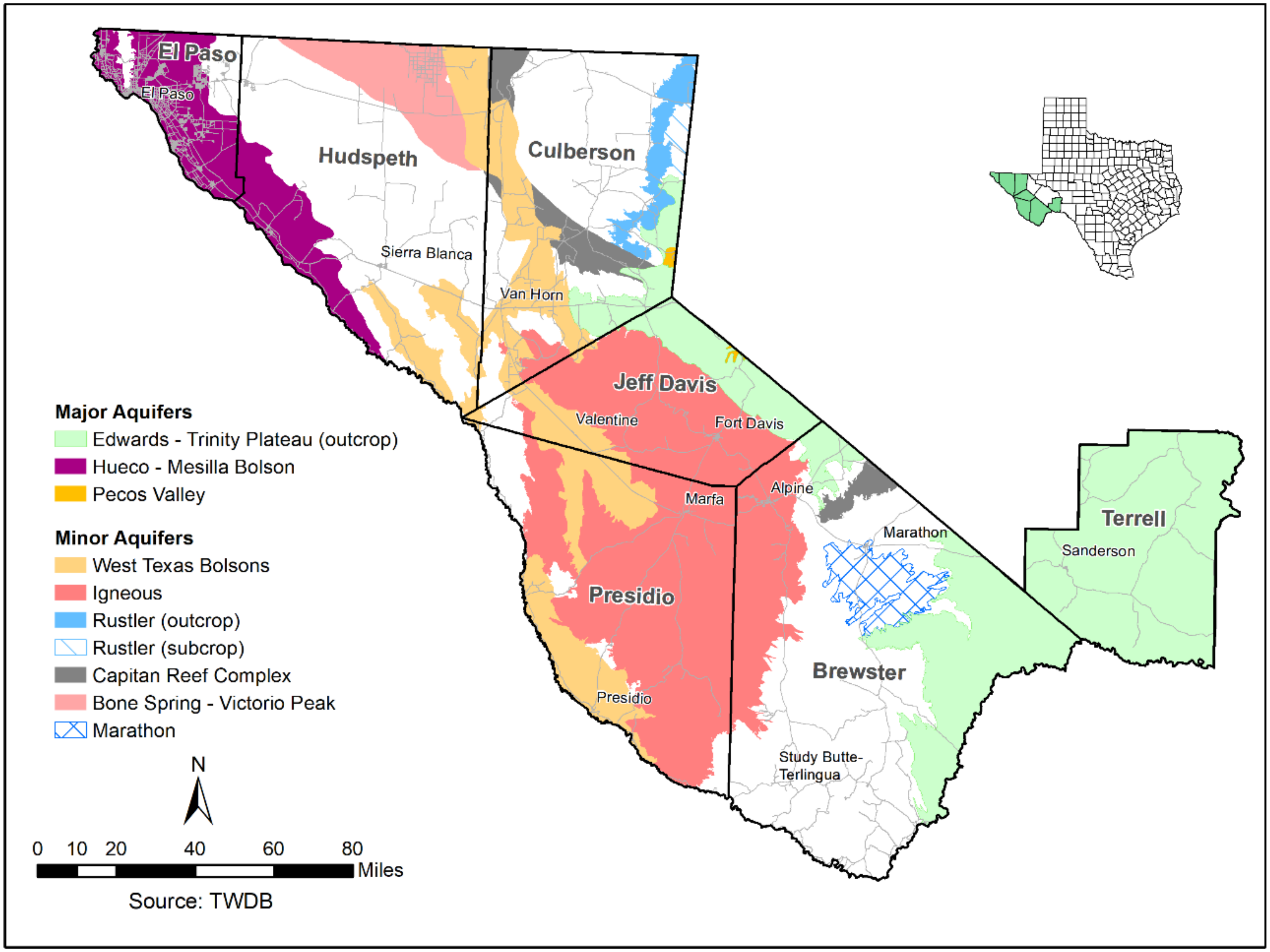

Figure 1-13. Major and Minor Aquifers of Far West Texas

1.5.1 Hueco and Mesilla Bolson Aquifers

The Hueco Bolson Aquifer extends from east of the Franklin Mountains in El Paso County southeastward into southern Hudspeth County, and continues a short distance north into New Mexico and south into Mexico. The Hueco Bolson along with the Mesilla Bolson Aquifer provides approximately half of the municipal supply for the City of El Paso and is the principal source of municipal supply for Ciudad Juarez, Mexico.

The Mesilla Bolson Aquifer lies in the Upper Rio Grande Valley west of the Franklin Mountains and extends to the north into New Mexico where it is primarily used for agricultural and public supply purposes. In Texas, the agricultural use of this aquifer is much less than in New Mexico. EPW's Canutillo Wellfield is located in the Mesilla Bolson.

1.5.2 West Texas Bolsons Aquifer

Several deep bolsons, or basins, filled with sediments eroded from the surrounding highlands underlie Far West Texas. In places, the bolsons contain significant quantities of groundwater. These bolsons are referred to as Red Light Draw, Eagle Flat, Green River Valley, Presidio-Redford, and the Salt Basin. The Salt Basin is subdivided from north to south into the Upper Salt Basin and Wild Horse, Michigan, Lobo, Ryan Flats. The bolson aquifers provide variable amounts of water for irrigation and municipal water supplies in parts of Culberson, Hudspeth, Jeff Davis and Presidio Counties. The communities of Presidio, Sierra Blanca, Valentine and Van Horn rely on the bolson aquifers for municipal water supplies.

1.5.3 Bone Spring-Victorio Peak Aquifer

The Bone Spring-Victorio Peak Aquifer is in northeast Hudspeth County along the eastern edge of the Diablo Plateau, west of the Guadalupe Mountains, and extends northward into the Crow Flats area of New Mexico. The aquifer is used primarily as a source of irrigation water. Dell City is the only municipality that relies on the aquifer as a source of public supply; however, the City must filter the water through a desalination process to render the water supply potable. The Hudspeth County Underground Water Conservation District #1 regulates the quantity of water withdrawn from the aquifer. The boundary of the district was recently extended to include the TWDB revised extent of the aquifer. EPW is in the process of purchasing properties overlying this aquifer as a potential future water-supply source (see EPW strategies in Chapter 5).

1.5.4 Igneous Aquifer

The Igneous Aquifer occurs in the Davis Mountains of Jeff Davis County and extends outward into Brewster and Presidio Counties. The Cities of Alpine, Fort Davis and Marfa rely on the aquifer as a source of municipal supply.

1.5.5 Edwards-Trinity (Plateau) Aquifer

The Edwards-Trinity (Plateau) Aquifer underlies the Edwards Plateau east of the Pecos River and the Stockton Plateau west of the Pecos River, and provides water to all or parts of 38 Texas counties. The aquifer extends from the Hill Country of Central Texas to the Trans-Pecos region of Far West Texas, where it is a source of water in Brewster, Culberson, Jeff Davis and Terrell Counties. There is relatively little pumpage from the aquifer over most of its extent in Far West Texas, with the City of Sanderson in

Terrell County being the only municipality in the Region that pumps water from the State-designated potion of this aquifer.

1.5.6 Capitan Reef Aquifer

The Capitan Reef Aquifer is contained within a relatively narrow strip of limestone formations (10 to 14 miles wide) that formed along the shelf edge of the ancestral Permian Sea. In Texas, the reef formations are exposed in the Guadalupe, Apache, and Glass Mountains and trend northward into New Mexico, where the aquifer is a source of abundant fresh water for the City of Carlsbad. Within Far West Texas, the aquifer underlies sections of Culberson County and a small area of northern Brewster County. EPWU owns approximately 29,000 acres overlying the Capitan Reef aquifer in northwestern Culberson County and may tap this aquifer for future needs (*see EPW strategies in Chapter 5*).

1.5.7 Marathon Aquifer

The Marathon Aquifer is located entirely within north-central Brewster County and is used primarily as a municipal water supply by the Community of Marathon and for rural domestic and livestock purposes.

1.5.8 Rustler Aquifer

The Rustler Formation is exposed in eastern Culberson County and plunges eastward into the subsurface of adjacent counties. The aquifer is principally located beneath Loving, Pecos, Reeves and Ward Counties, where it yields water for irrigation, livestock and water-flooding operations in oil-producing areas. No communities in Far West Texas rely on this aquifer as large concentrations of dissolved solids render the water unsuitable for human consumption.

1.5.9 Pecos Valley (Balmorhea Alluvium) Aquifer

The Pecos Valley Aquifer, locally referred to as the Balmorhea Alluvium Aquifer, is located in a small area along the Jeff Davis and Reeves county line and is composed of a relatively shallow layer of gravel that overlies Cretaceous limestone. The Balmorhea Alluvium Aquifer is recognized in this *Plan* due to its use as a municipal supply source for the City of Balmorhea and the Madera Valley WSC, both located in Reeves County in the adjacent Region F.

1.5.10 Other Groundwater Resources

Also shown in Figure 1-13 are large areas of Far West Texas that are not underlain by designated major or minor aquifers. The map, however, should not be interpreted as an indication that such areas are devoid of groundwater, but rather as a reflection of the current level of understanding of the extent of known groundwater resources in the Region.

<u>Rio Grande Alluvium Aquifer</u>

The Rio Grande Alluvium Aquifer consists of Quaternary floodplain sediments laid down by the Rio Grande as the river cut into the surface of the Hueco Bolson. The floodplain forms a narrow valley within the topographically lowest part of the Hueco Bolson and extends nearly 90 miles from El Paso to Fort Quitman, where the valley is constricted between the Sierra de la Cienguilla of Chihuahua and the Quitman Mountains of Hudspeth County. The aquifer is hydrologically connected with the underlying

Hueco Bolson, and is occasionally a source of irrigation water for farms in El Paso and Hudspeth Counties.

Edwards-Trinity (Plateau) Aquifer of Brewster County

In southern Brewster County, the communities of Lajitas, Study Butte, and Terlingua, as well as much of Big Bend National Park, withdraw their municipal supplies from Cretaceous limestone aquifers that are equivalent to the Edwards-Trinity (Plateau) Aquifer. Further evaluation is needed to arrive at a better understanding of the water-resource development potential in these areas.

Diablo Plateau Aquifer

Thick limestone beds that make up the subsurface of the Diablo Plateau of central and northern Hudspeth County (west of Dell City) may have significant volumes of groundwater in storage. Although relatively few exploration wells have been drilled on the Plateau, the aquifer likely contains sufficient water to be considered as a potential source of groundwater.

1.6 MAJOR SPRINGS

Springs and seeps are found in all seven of the Far West Texas counties and have played an important role in the development of the Region. Springs were important sources of water for Native Americans as indicated by the artifacts and petroglyphs found near many of the springs. In the 18th and 19th centuries, locations of transportation routes including supply and stage coach lines, railroads, military outposts, and early settlements and ranches were largely determined by the occurrence of springs that issued from locations in the mountains and along mountain fronts. Figure 1-14 shows the regional distribution of documented springs in the Region that are currently in existence or are of historical significance.

Springs contribute to the esthetic and recreational value of private land and parkland in Far West Texas, especially in the Big Bend area where thermal springs discharge along the banks of the Rio Grande. Springs are significant sources of water for both aquatic and terrestrial wildlife as they form small wetlands that attract migratory birds and other fowl that inhabit the Region throughout the year. As documented by the Texas Parks and Wildlife Department, springs also provide habitat for threatened and endangered species of fish (such as the Pecos and the Big Bend Gambusia).

The FWTWPG recognizes the importance of all springs in this desert community for their contribution as a water supply source and as natural habitat. However, the FWTWPG chooses to respect the privacy of private lands and therefore specifically identifies the following "Major Springs" occurring only on state, federal, or privately owned conservation managed lands (Figure 1-15). Many of these springs also are the primary source of flow to the "ecologically unique river and stream segments" described in Chapter 8. Descriptions of these springs are provided in Appendix 1A of this *Plan*.

La Baviza Spring, Chinati Mountains State Natural Area – Presidio County

Big Bend National Park / Rio Grande Wild and Scenic River Springs – Brewster County

- Gambusia Hot Springs Complex
- Outlaw Flats Spring Complex
- Las Palmas Spring Complex
- Madison Fold Spring Complex

Guadalupe Mountains National Park – Culberson County

- Bone Spring
- Dog Canyon Spring
- Frijole Spring
- Goat Seep
- Guadalupe Spring
- Juniper Spring
- Manzanita Spring

- Smith Spring
- Upper Pine Spring

Texas Nature Conservancy – Independence Creek Preserve – Terrell County

- Caroline Spring

Texas Nature Conservancy – Davis Mountains Preserve – Jeff Davis County

- Tobe Spring
- Bridge Spring
- Pine Spring
- Limpia Spring

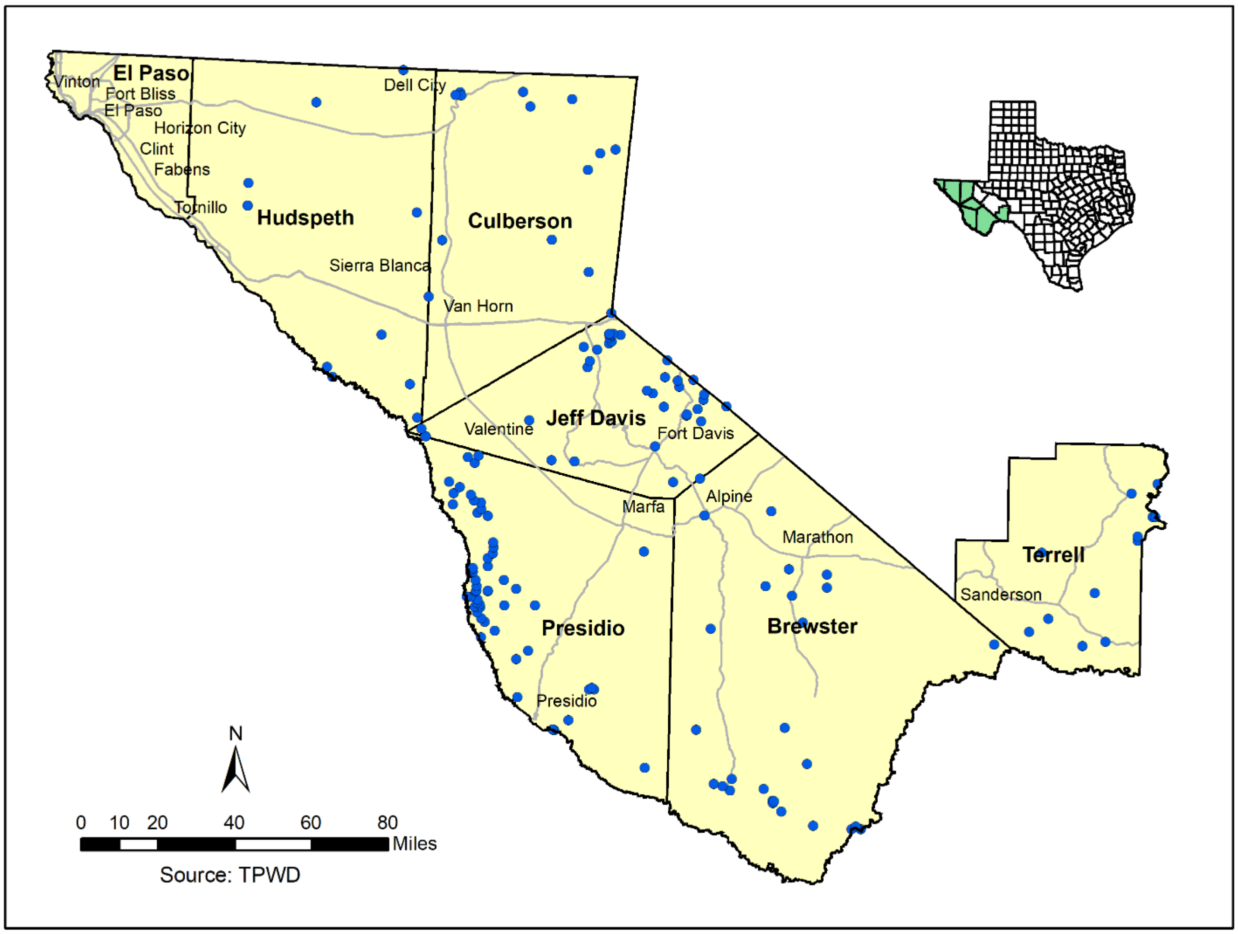

Figure 1-14. Location of Documented Springs

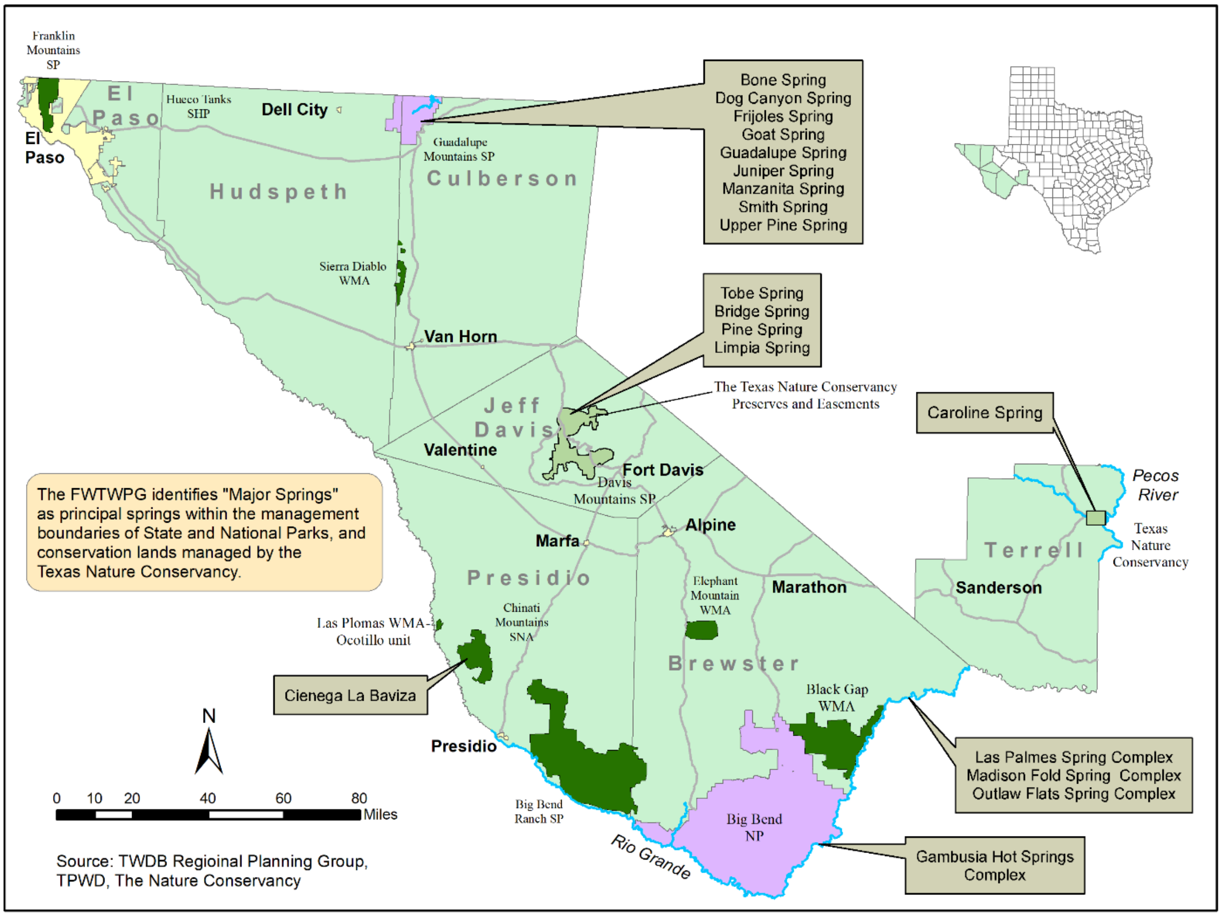

Figure 1-15. Location of Identified Major Springs

1.7 REUSE

El Paso water has nearly 50 miles of reclaimed-water (purple) pipelines throughout all areas of the City. Reclaimed (non-potable) water serves the landscape irrigation demand of golf courses, parks, schools, and cemeteries, and provides water supplies for steam-electric plants and industries within the City. EPW does not plan on extending or growing the purple pipe infrastructure, but will focus on maintaining existing purple pipe customers and work towards increasing the use of reclaimed water through additional purified water projects. EPW also develops direct reuse supplies through its advanced water purification process producing potable public supply water. The City of Alpine in Brewster County is also reusing treated wastewater to irrigate city-owned park land.

Indirect reuse of treated non-potable municipal wastewater discharged into the Rio Grande occurs in El Paso and Hudspeth Counties where it is reapplied for irrigation use by the El Paso County Water Improvement District No. 1 and the Hudspeth County Conservation and Reclamation District No.1.

1.8 IDENTIFIED WATER QUALITY PROBLEMS

Water quality plays an important role in determining the availability of water supplies to meet current and future water needs in the Region. The quality of groundwater and surface water is evaluated to help determine the suitability of each source for use and the potential impacts on these sources that might result from the implementation of recommended water management strategies.

1.8.1 Water Quality Issues

Groundwater quality issues in the Region are generally related to naturally high concentrations of total dissolved solids (TDS) or to the occurrence of elevated concentrations of individual dissolved constituents. High concentrations of TDS are primarily the result of the lack of sufficient recharge and restricted circulation. Together, these retard the flushing action of fresh water moving through the aquifers. Some aquifers, however, have a low TDS but may contain individual constituent levels that exceed safe drinking-water standards. For example, some wells in the Davis Mountains Igneous Aquifer have exceptionally low TDS but contain unsatisfactory levels of fluoride. Also, fresh-water wells in the Study Butte-Terlingua- Lajitas area have elevated levels of radioactivity.

Groundwater quality changes are often the result of man’s activities. In agricultural areas, aquifers such as the Bone Spring-Victorio Peak have increased in TDS. Irrigation water applied on the fields percolates back to the aquifer carrying salts leached from the soil. Beneath El Paso and Ciudad Juarez, the average concentration of dissolved solids in the Hueco Bolson Aquifer has increased as the fresher water in the aquifer is being consumed. Although local instances of groundwater quality degradation have occurred in the Region, there are no major trends that suggest a widespread water-quality problem due to the downward percolation of surface contaminants.

Arsenic is a costly problem in El Paso County. With the lowering of the maximum contaminant level to 10ppd, municipal utilities have been required to upgrade their treatment facilities to meet the new standard.

The Rio Grande and the Pecos River are the principal surface water sources in Far West Texas. Unlike groundwater, surface water quality can vary significantly depending on the amount of flow in the streambed and the rate and source of runoff from adjacent lands. Salinity is an issue associated with the Rio Grande, especially during drought conditions. River flows arriving at El Paso contain a substantial salinity contribution from irrigation return flow and municipal wastewater return in New Mexico. Under current conditions, approximately 25 percent of the applied irrigation water is needed to move through the project in El Paso County to keep the salt loading at reasonable and manageable levels given average surface flow rates. Studies have shown that salinities in the Rio Grande can increase to over 1,000 mg/l during May and September, depending on actual irrigation demands and releases from reservoirs. Prolonged low flow increase salt storage in riverbanks and riparian zones, which can then be flushed out during high flows.

Downstream from El Paso, most of the flow consists of irrigation return flow, and small amounts of treated and untreated municipal wastewater. Heavy metals and pesticides have been identified along this segment of the Rio Grande. Flow is intermittent downstream to Presidio, where the Rio Conchos augments flow. Fresh water springs contribute to the Rio Grande flow in the Big Bend and enhance the overall quality of the River through this reach.

The Pecos River is not a source of drinking water for communities in Far West Texas; however, it is the most prominent tributary to the Rio Grande on the Texas side of the River above Amistad Reservoir. Per IBWC data, the Pecos River contributes an average of 11 percent of the annual stream flow in the Rio Grande above the Reservoir and 29 percent of the annual salt load. Independence Creek's contribution in Terrell County increases the Pecos River water volume by 42 percent at the confluence and significantly reduces the total suspended solids, thus improving both water quantity and quality.

1.8.2 Supply Source Protection

According to the 1996 Safe Drinking Water Act Amendments, the Texas Commission on Environmental Quality (TCEQ) is required to assess every public drinking water source for susceptibility to certain chemical constituents. The Source Water Protection Program is a voluntary program designed to help public water systems identify and implement measures that will protect their sources of water from potential contamination. Assessment reports are provided to the public water systems and are often used to implement local source water protection projects. Table 1-1 lists Far West Texas public water systems currently involved in the TCEQ's Source Water Protection Program.

Table 1-1. Far West Texas Source Water Protection Participants

Utility Name	County	Report Date
Castolon Paint Area BBNP	Brewster	5/30/2000
Panther Junction PLT	Brewster	7/30/2000
Rio Grande Village BBNP	Brewster	5/31/2000
Big Bend National Park Chisos Basin Water	Brewster	5/31/2000
City of Van Horn	Culberson	7/31/1994
El Paso Water Utilities Public Service Board	El Paso	5/31/1990
El Paso County WCID 4 Fabens	El Paso	7/31/1999
El Paso County Tornillo WID	El Paso	7/31/1999
Fort Bliss Main Post Area	El Paso	7/31/1990
Dell City	Hudspeth	7/31/1994
For Davis WSC	Jeff Davis	7/31/1994
City of Marfa	Presidio	1/31/1995

1.8.3 Water-Supply Source Vulnerability

Following the events of September 11th 2001, Congress passed the Bio-Terrorism Preparedness and Response Act. Drinking water utilities serving more than 3,300 people were required and have completed vulnerability preparedness assessments and response plans for their water, wastewater, and stormwater facilities. The U.S. Environmental Protection Agency (EPA) funded the development of three voluntary guidance documents, which provide practical advice on improving security in new and existing facilities of all sizes. The documents include:

- In*terim Voluntary Security Guidance for Water Utilities* www.awwa.org
- *Interim Voluntary Security Guidance for Wastewater/Stormwater Utilities* www.wef.org
- *Interim Voluntary Guidelines for Designing an Online Contaminant Monitoring System* www.asce.org

1.9 WATER LOSS AUDITS

In 2003, the 78th Texas Legislature, Regular Session, enacted House Bill 3338 to help conserve the State's water resources by reducing water loss occurring in the systems of drinking water utilities. This statute requires that retail public utilities providing water within Texas file a standardized water audit once every five years with the Texas Water Development Board (TWDB). In response to the mandates of House Bill 3338, TWDB developed a water audit methodology for utilities that measures efficiency, encourages water accountability, quantifies water losses, and standardizes water loss reporting across the State. This standardized approach to auditing water loss provides utilities with a reliable means to analyze their water loss performance. By reducing water loss, utilities can increase their efficiency, improve their financial status, minimize their need for additional water resources, and assist long-term water sustainability.

Any retail water supplier that has an active financial obligation with the TWDB is required to submit a water loss audit annually. Additionally, retail water suppliers with more than 3,300 connections are now required to submit an audit annually. In addition, all retail public water suppliers are required to submit a water loss audit once every five years.

Utilizing a methodology derived from the American Water Works Association (AWWA) and the International Water Association (IWA), the TWDB has published a manual that outlines the process of completing a water loss audit: Water Loss Audit Manual for Texas Utilities – TWDB Report 367 (2008), which can be viewed at http://www.twdb.texas.gov/publications/brochures/conservation/doc/WaterLossManual_2008.pdf. Table 1-2 provides a listing of reported utility audits performed in Far West Texas that reported a loss of more than 10 percent (note: No utilities reported more than a 10 percent loss in 2017). The link provided below accesses a more detailed water loss audit report maintained by the TWDB (http://www.twdb.texas.gov/conservation/municipal/waterloss/index.asp).

Table 1-2. Far West Texas 2015-2016 Public Water System Real Water Loss Report for Utilities with Greater than a 10 Percent Loss (gallons per year)

PWS Name	Report Year	Reported Breaks Leaks	Unreported Loss	Total Real Losses	Cost of Real Losses ($)	Total Loss Percent
City of Presidio	2015	5,000,000	26,854,879	31,854,879	31,855	21.5
East Montana Water System	2016	2,385,000	48,009,515	50394515	349,688	19.2
Haciendas Del Norte WID	2015	5,000,000	3,689,434	8,689,434	14,772	20.5
Horizon Regional MUD	2015	0	224,268,829	224,268,829	201,842	14.9
Lajitas On The Rio Grande	2016	0	31,774,172	31,774,172	63,548	60.3
Marathon WSC	2016	150,000	6,140,301	6,290,301	1,635	27.7
Study Butte Terlingua Water System	2015	1,370,000	8,797,639	10,167,639	17,285	51.3

* American Water Works Association (AWWA) recommends entities with more than 10% water loss take corrective action.

1.10 COLONIAS

1.10.1 Far West Texas Colonias

Colonias represent a special and growing subset of municipal water demand in the Region and present a challenge to water suppliers. While some colonias in the Region are centuries-old historic settlements, most are substandard subdivisions in unincorporated areas located along the United States/Mexico international border that have been illegally subdivided into small parcels characterized by a lack of basic services. These small parcels do not have a drinking water supply, wastewater services, paved roads, or proper drainage, and are typically sold to individuals of modest means who may be unaware of the negative consequences of purchasing illegally subdivided property. Public health problems are often associated with these colonias.

The office of the Attorney General of Texas recognizes 312 subdivisions that qualify as colonias in the counties that make up the Far West Texas region (Table 1-3). Of these 312 colonias, 292 are concentrated in El Paso County.

Table 1-3. Far West Texas Colonia

Brewster County	Culberson County	El Paso County	Hudspeth County	Jeff Davis County	Presidio County	Terrell County
Marathon	Ranch Estates	292 Individual Colonias	Acala	Valentine	Candelaria	Dryden
Study Butte	Van Horn		Sierra Blanca		Pueblo Nuevo	Sanderson
Terlingua			Fort Hancock East		Shafter	
			Villa Alegre		Las Pamps	
			Loma Linda Estates		Redford	
					Loma Pelona	
					Ruidosa	

1.10.2 TWDB Economically Distressed Area Program

The Economically Distressed Area Program (EDAP) was created by the Texas Legislature in 1989 and is administered by the TWDB. The intent of the program is to provide local governments with financial assistance for bringing water supply and wastewater services to the colonias. An economically distressed area is defined as one in which water supply or wastewater systems are not adequate to meet minimal State standards, financial resources are inadequate to provide services to meet those needs, and there was an established residential subdivision on June 1, 2005. Affected areas are counties adjacent to the Texas/Mexico border, or that have per capita income 25 percent below the State median and unemployment rates 25 percent above the State average for the most recent three consecutive years for which statistics are available. Additional information pertaining to eligibility and requirements for this program are available on the TWDB web site http://www.twdb.texas.gov/financial/programs/EDAP/index.asp.

EDAP projects in Far West Texas are in Brewster, El Paso, Hudspeth, and Terrell Counties and are described in Table 1-44. Data pertaining to all EDAP projects in the State can be accessed through the TWDB web site http://www.twdb.texas.gov/publications/reports/edap_reports/doc/Status.pdf.

Table 1-4. Economically Distressed Area Program Projects (February 28, 2019)

County	Sponsor	Project	Cost	Status
Brewster	City of Alpine	Collection System Improvements	$290,000	Completed
El Paso	City of El Paso	Canutillo Project	$7,432,879	Completed Facility Planning and Construction
El Paso	City of El Paso	Westway Water Supply	$1,437,540	Completed Facility Planning and Construction
El Paso	City of El Paso	Montana Vista Wastewater Planning	$15,703,016	Active Planning
El Paso	El Paso County	East Montana Water System (Phase 1)	$6,321,453*	Completed Construction
El Paso	El Paso County	East Montana Water System (Phase 2&3)	$10,653,496*	Completed Construction
El Paso	El Paso County	Turf Estates Water Line	$895,919	Completed Facility Planning and Construction
El Paso	El Paso County	Canutillo Area Water & Wastewater	$412,730	Completed PAD
El Paso	El Paso County	Canutillo Water (Norma & Georgia)	$90,000	Completed PAD
El Paso	El Paso County	Colonia Plumbing Fixtures	$1,368,392	Completed Construction
El Paso	El Paso County	Colonia Assistance & Management Support	$213,250	Completed Facility Planning
El Paso	El Paso WCID	Westway II	$5,459,674*	Completed Construction
El Paso	Lower Valley Water District	Phase 1 – Bauman Water Project	$1,800,608	Completed Construction
El Paso	Lower Valley Water District	Phase 2 - Socorro	$17,793,361*	Completed Facility Planning and Construction
El Paso	Lower Valley Water District	Phase 3 - San Elizario	$88,947,685*	Completed Facility Planning and Construction
El Paso	Lower Valley Water District	Las Azaleas Planning	$50,000	Completed Facility Plan
El Paso	Lower Valley Water District	Cultural Resource Management - Socorro	$1,200	Completed Construction
El Paso	Vinton	Water & Wastewater Planning	$39,100	Completed Facility Planning
El Paso	El Paso County Tornillo WID	Tornillo Wastewater System	$13,157,652	Completed Facility Planning and Construction
Hudspeth	Hudspeth County WCID #1	Sierra Blanca Wastewater System	$2,146,966	Completed PAD and Construction
Hudspeth	Ft. Hancock WCID	Water Well and RO Treatment Facility	$3,012,989	Completed Construction
Terrell	Terrell County WCID #1	Sanderson Wastewater System	$4,232,175	Completed Facility Planning and Construction

*Cost * - Projects also receiving other TWDB funds.*

1.10.3 El Paso County Colonias

Over the past two decades, EPW has served as a program manager to assist outlying water districts in applying for funding, master planning, design, and construction management. As regional water planner for El Paso County, EPW continues to work with various water districts and colonia residents to consolidate efforts in securing adequate water supplies and to capitalize on economies of scale. Efforts to provide water service to outlying areas have resulted in approximately 97 percent of the population within El Paso County having access to clean potable water.

Projects shown in Table 1-4 are in different stages of consideration. Funding has, and continues to be, the greatest challenge in moving forward with these projects. Given the limited number of residents (connections) and the large construction costs associated with each project, there are many areas where it is simply not feasible to construct needed facilities until either an increased number of connections are made and/or most importantly, increased amounts of state and federal grant funding are available. In certain areas, it may be feasible to consider small onsite treatment systems, such as wellhead reverse osmosis systems. Such systems could be less expensive and allow for residents to obtain water until a more direct municipal supply is available. EPW continues to take the lead in identifying funding and in managing the projects within and/or on behalf of El Paso County. Title 30, Texas Administrative Code, Chapter 285 and the Texas Health and Safety Code, Chapter 366, §366.032 requires residents in rural areas of the county who do not have piped sewer infrastructure to comply with septic tank installation standards and receive a certificate of compliance prior to receiving water, gas, and electric utility service. Known as the On Site Septic Facility (OSSF) program, this program is intended to prevent unhealthy conditions and protect underground water, and is enforced by the El Paso City/County Health and Environmental District.

1.11 INTERNATIONAL WATER ISSUES

1.11.1 Ciudad Juarez

Ciudad Juarez is located across the Rio Grande from the City of El Paso and currently is 100 percent dependent on the Hueco Bolson and Conejos Medanos Aquifers to satisfy all its municipal and industrial demands. Pumping from the Hueco by Ciudad Juarez since 2000 is summarized in Table 1-5.

Table 1-5. Ciudad Juarez Hueco Groundwater Pumping (Acre-Feet/Year)

Year	Groundwater Pumping
2000	126,172
2001	124,735
2002	124,676
2003	125,144
2004	119,234
2005	122,315
2006	126,655
2007	129,193
2008	132,889
2009	130,735
2010	131,055
2011	119,137
2012	117,709
2013	122,596
2014	128,823
2015	132,899
2016	135,844
2017	137,286
2018	141,896

Pumping continues to increase each year in response to the population rise. However, water conservation efforts in Ciudad Juarez have somewhat offset increased population and service connections. With a growing population that is currently estimated to be over 1.5 million, Ciudad Juarez recognizes the limitations of the Hueco Bolson to supply future demands. Future supplies are anticipated from the following "imported" groundwater sources:

- Bismark Mine (26,000 acre-feet/year)
- Mesilla (26,000 acre-feet/year)
- Somero (28,000 acre-feet/year)
- Profundo (31,000 acre-feet/year)

In addition, plans are also being developed to convert 38,000 acre-feet/year of surface water from the Rio Grande (Rio Bravo) for use as municipal supply. Currently, Mexico's allocation from the Rio Grande Project of 60,000 acre-feet/year is used for irrigated agriculture. The conversion would involve supplying wastewater effluent to farmers in exchange for surface water.

1.11.2 City of El Paso

The City of El Paso, through their water utility, El Paso Water, manages groundwater from the Hueco and Mesilla Bolson Aquifers as a drought supply. When surface water is not available (typically the winter and spring months) the Hueco Bolson Aquifer specifically is heavily pumped, becoming a major source of water for the east side of El Paso. However, when surface water is available, pumping from the Hueco decreases.

EPW has consistently decreased its groundwater dependence on the Hueco Bolson with its increased use of surface water (Rio Grande), reclaimed water, and water conservation. However, during periods of severe river drought, groundwater pumpage from the Hueco Bolson including the KBH desalination plant will be increased dramatically to offset the limited river supply.

In 2013, surface water availability was only 10,000 acre-feet (from the Rio Grande) due to severe drought conditions. As a result, the Hueco production was maximized. Although drought conditions have improved, surface water is limited, causing the Hueco Bolson Aquifer, along with the Mesilla Bolson Aquifer, to remain a critical groundwater supply source.

1.11.3 Transboundary Effects of Groundwater Pumpage

Prior to 1960, up to 5,000 acre-feet/year of groundwater flowed underground from Mexico to Texas as a result of higher pumping in El Paso than in Ciudad Juarez. However, since 1960, groundwater has generally flowed from Texas into Mexico due to increases in Ciudad Juarez pumping. The rate of flow has been about 33,000 acre-feet/year over the last decade. With continuous pumping from both Ciudad Juarez and El Paso, both cites have experienced extensive water-level drawdowns and water-quality degradation due to lateral brackish water intrusion into the freshwater zones. Brackish water intrusion from irrigation return flow drains continues to expand laterally and vertically, and to degrade water quality in the shallow alluvium along the Rio Grande.

1.11.4 Transboundary Aquifer Assessment Program

The Transboundary Aquifer Assessment Program (TAAP) is a joint effort between Mexico and the United States to evaluate shared priority aquifers is the product of US Public Law 109-448 (United States-Mexico Transboundary Aquifer Assessment Act of 2006). Parties involved included the International Boundary and Water Commission (IBWC/CILA), the Mexican National Water Commission (CONAGUA), the US Geological Survey (USGS), New Mexico State University and the Universities of Sonora, Texas, and Arizona. Project and research management in the Far West Texas region is conducted by Texas A&M AgriLife of El Paso.

The overall goal of the Program includes:

- Develop binational information and shared databases on groundwater quantity and quality;
- Identify and delineate transboundary aquifers of importance;
- Develop binational criteria for determination of priority transboundary aquifers;
- Assess the extent, availability, and movement of water in transboundary aquifers and the interaction with surface water;
- Develop and improve groundwater-flow information for binational aquifers to facilitate water-resource assessment and planning;
- Analyze trends in groundwater quality, including salinity and nutrients;

- Apply new data, models, and information to evaluate strategies to protect water quality and enhance supplies; and
- Provide useful information to decision makers, including assessments of groundwater management institutions and policies.

Fifteen transboundary aquifers have been identified between Mexico and Texas, though the mechanisms for hydrogeologic connection across the international boundary are known only for five. The transboundary groundwater resources shared by the two countries are largely uncharacterized due to lack of data, differences in aquifer boundary delineations and methodologies, and the limited cooperation and coordination among federal, state, and local agencies within and between these countries to address groundwater issues from a binational perspective.

Four identified transboundary aquifers are categorized as priority aquifers: Hueco Bolson/Valle de Juarez, Mesilla/Conejos- Medanos, Santa Cruz, and San Pedro. In the general area of Far West Texas, the region of the bolsons (aquifers located southeast of the Conejos-Medanos/Mesilla Bolson, Valle de Juarez/Hueco-Tularosa Bolson Aquifer in northern Chihuahua, in southern New Mexico and western Texas) appear to be the most important areas for transboundary aquifer development.

Overall, the hydrogeological units along the Texas-Mexico border cover around 182,000 km^2 (approximately 110,000 km^2 on the Texas side and 72,000 km^2 on the Mexico side) (Sanchez et al. 2018). The total area considered to have good aquifer potential (defined as the favorable lithological properties that allow sustained and significant rates of pumpage) as well as good water quality ranges between 50% and 60% (60% of this in Texas). Some 20 to 25% of the hydrogeological units that cross the border area are considered to have poor aquifer potential and poor water quality, with the proportion of land being approximately equal on both sides of the border.

1.12 STATE AND FEDERAL AGENCIES WITH WATER RESPONSIBILITIES

Texas Water Development Board (TWDB)

The TWDB (http://www.twdb.texas.gov/), especially the Water Resources Planning and Information Division, is at the center of the Senate Bill 1 regional water planning effort. The agency has been given the responsibility of directing the effort to ensure consistency and to guarantee that all regions of the State submit plans in a timely manner. Results of the 16 regional water plans are then incorporated by the TWDB into a State Water Plan. The TWDB also administers financial grant and loan programs that provide funding for water research and facility planning projects.

Texas Commission on Environmental Quality (TCEQ)

The TCEQ (http://www.tceq.texas.gov/) strives to protect the State's natural resources, consistent with a policy of sustainable economic development. TCEQ's goal is clean air, clean water, and the safe management of waste, with an emphasis on pollution prevention. The TCEQ is the major State agency with regulatory authority over State waters in Texas. The TCEQ is also responsible for ensuring that all public drinking-water systems are in compliance with the strict requirements of the State of Texas.

Texas Parks and Wildlife Department (TPWD)

The TPWD (http://www.tpwd.state.tx.us/) mission is to manage and conserve the natural and cultural resources of Texas and to provide hunting, fishing and outdoor recreation opportunities for the use and enjoyment of present and future generations. The agency currently has six program divisions: Wildlife, Coastal Fisheries, Inland Fisheries, Law Enforcement, State Parks, and Infrastructure.

Texas Department of Agriculture (TDA)

The TDA (http://www.texasagriculture.gov/Home.aspx) was established by the Texas Legislature in 1907. The TDA has marketing and regulatory responsibilities and administers more than 50 separate laws. The current duties of the department include: (1) promoting agricultural products locally, nationally, and internationally; (2) assisting in the development of the agribusiness in Texas; (3) regulating the sale, use and disposal of pesticides and herbicides; (4) controlling destructive plant pests and diseases; and (5) ensuring the accuracy of all weighing or measuring devices used in commercial transactions. The department also collects and reports statistics on all activities related to the agricultural industry in Texas.

Texas State Soil and Water Conservation Board (TSSWCB)

The TSSWCB (http://www.tsswcb.texas.gov/) is charged with the overall responsibility for administering the coordination of the State's soil and water conservation program with the State's soil and water conservation districts. The agency is responsible for planning, implementing, and managing programs and practices for abating agricultural and forest nonpoint source pollution. Currently, the agricultural/forest nonpoint source management program includes problem assessment, management program development and implementation, monitoring, education, and coordination.

International Boundary and Water Commission (IBWC) and Comisión Internacional de Límites y Aquas (CILA)

The IBWC (http://ibwc.state.gov/) and CILA provide binational solutions to issues that arise during the application of United States – Mexico treaties regarding boundary demarcation, national ownership of waters, sanitation, water quality, and flood control in the border region; the treaties are discussed in Chapter 3.

United States Bureau of Reclamation (USBR)

The stretch of the Rio Grande from Elephant Butte Dam (approximately 100 miles north of El Paso) to Fort Quitman, Texas, is within a federal reclamation project known as the Rio Grande Project. The Bureau of Reclamation manages (http://www.usbr.gov/) the Elephant Butte Dam and the Caballo Reservoir in New Mexico, and determines the amount and timing of all water releases to Texas, with the input of the El Paso County Water Improvement District #1. The Bureau is guided by the terms of the Rio Grande Compact. The Bureau has asserted title to all the water in the Project in a lawsuit styled United States v. EBID, et al, which is currently being litigated.

United States Geological Survey (USGS)

The USGS (http://www.usgs.gov/) is responsible for fulfilling the Nation's needs for reliable, impartial scientific information to describe and understand the Earth. This information is used to minimize loss of life and property from natural disasters; manage water, biological, energy, and mineral resources; and enhance and protect the quality of life. The USGS is the Federal Government's principal civilian map-making agency; the primary source of its data on the quality and quantity of the Nation's water resources; the Nation's primary provider of earth-science information on natural hazards, mineral and energy resources, and the environment; and the major partner in developing the Nation's understanding of the status and trends of biological resources and the ecological factors affecting living resources.

United States Environmental Protection Agency (EPA)

The mission of the EPA (http://www.epa.gov/) is to protect human health and the environment. Programs of the EPA are designed to (1) promote national efforts to reduce environmental risk, based on the best available scientific information; (2) ensure that federal laws protecting human health and the environment are enforced fairly and effectively; (3) guarantee that all parts of society have access to accurate information sufficient to manage human health and environmental risks; and (4) guarantee that environmental protection contributes to making communities and ecosystems diverse, sustainable and economically productive.

United States Fish and Wildlife Service (USFWS)

The USFWS (http://www.fws.gov/) enforces federal wildlife laws, manages migratory bird populations, restores nationally significant fisheries, conserves and restores vital wildlife habitat, protects and recovers endangered species, and helps other governments with conservation efforts. It also administers a federal aid program that distributes money for fish and wildlife restoration, hunter education, and related projects across the country.

1.13 LOCAL ORGANIZATIONS AND UNIVERSITIES

The public and even those involved in water planning and management find it difficult to know about or keep track of the large number and wide array of organizations involved with water resource issues in Far West Texas. Following is a list of many these organizations. Because of the hydrologic, cultural and economic connections of Far West Texas with Southern New Mexico and Mexico, this list includes water organizations in this expanded region. The list is likely incomplete as there are certainly other organizations deserving of being included.

Alliance for the Rio Grande Heritage

Border Environmental Cooperation Commission

City of El Paso

- Water Conservation Advisory Board
- Rio Grande Riverpark Task Force
- El Paso Water – Consortium for Hi-Technology Investigations in Water and Wastewater
- El Paso water – TecH2O Learning Center

City of Las Cruces

- Rio Grande Riparian Ecological Corridor Project

Consortium for Hi-Technology Investigations in Water and Waste Water

Environmental Defense

Forest Guardians

Hudspeth Directive for Conservation

New Mexico State University

New Mexico Lower Rio Grande Regional Water Users Organization

New Mexico Water Conservation Alliance

New Mexico Water Resources Research Institute

New Mexico Water Task Force

New Mexico Water Trust Board

New Mexico-Texas Water Commission

North American Commission for Environmental Cooperation

North American Development Bank

Paso Del Norte Watershed Council

Paso Del Norte Water Task Force

Project Del Rio

Rio Grande/Rio Bravo Basin Coalition

Rio Grande Council of Governments

Rio Grande Institute

Rio Grande Watershed Federal Coordinating Committee

Southwest Environmental Center

The Texas A&M University System

- Texas AgriLife Research Center in El Paso
- Transboundary Aquifer Assessment Program
- Texas Cooperative Extension
- Rio Grande Basin Initiative
- Texas Water Resources Institute

Texas State University System

- Sustainable Agricultural Water Conservation in the Rio Grande
- Basin Project

Texas Water Matters

- Lone Star Chapter of the Sierra Club
- National Wildlife Federation
- Environmental Defense

Tularosa Basin National Desalination Research Facility

University of Texas at El Paso

- Center for Environmental Resource Management
- Rio Bosque Wetlands Park
- Southwest Consortium for Environmental Research and Policy of the Southwest

U. S. Mexico Border Coalition of Resource Conservation and Development Councils

WERC: A Consortium for Environmental Education and Technology Development

World Wildlife Fund – Chihuahuan Desert Program

APPENDIX 1A
MAJOR SPRINGS

MAJOR SPRINGS

The Far West Texas Water Planning Group recognizes the following "Major Springs" occurring on state, federal, or privately owned conservation-managed lands for their importance for natural resource protection.

CHINATI MOUNTAINS STATE NATURAL AREA – CIENEGA LA BAVIZA SPRING

Cienega Creek flows downstream from the spring-fed spring, La Baviza, in the 38,187-acre Chinati Mountains State Natural Area in west-central Presidio County. The spring (cienega) forms a fresh to slightly saline marsh with waters that are slightly geothermal. The habitat supports an intact, diverse marsh with saline grasses, rushes, sedges, and perennials. A high diversity of desert bats also use the area for feeding and watering. The adjacent Cienega Creek has very good examples of saline marsh and cottonwood gallery woodlands. It is an important wildlife area and is in the low Chihuahuan Desert where intact wetlands and riparian habitat are quite rare. Cienega Creek is recommended as an "Ecologically Unique River or Stream Segment" in Chapter 8.

BIG BEND NATIONAL PARK / RIO GRANDE WILD AND SCENIC RIVER SPRING COMPLEXES

River regulation, agricultural and municipal withdrawals and drought have diminished and altered the discharge patterns for the lower Rio Grande in Far West Texas. The physical and ecological system, once adapted to large and rapid fluctuations in flow, is now adapted to lower and more constant flows. The 250-mile reach of the Rio Grande managed by the National Park Service is the only free flowing reach in the lower Rio Grande. A significant portion of the base flows are provided by groundwater contributions from four spring complexes located in Big Bend National Park and along the Rio Grande Wild and Scenic River. Management Plans for both NPS entities list the protection of springs as critical management concerns. A portion of the Rio Grande Wild and Scenic River is recommended by the planning group as an "Ecologically Unique River and Stream Segment" and is discussed in Chapter 8. NPS staff has identified the following four spring complexes.

Gambusia Hot Springs Complex

River miles	804	814
UTM Coordinates N	3233835	3226468
UTM Coordinates E	702647	694388
Zone 13		

This reach includes hot springs between Mariscal Canyon and Boquillas Canyon. Easily delineated orifices with significant flow include: Gravel Pit, Langford Hot Springs, Lower Hot Springs (a.k.a. VD Springs or Leper Springs), Rio Grande Village Springs 3 and 4, and numerous unnamed springs. Springs on the Mexican side include Ojo Caliente and Boquillas Hot Springs. These springs issue from the upper Cretaceous rock units, the Boquillas and Santa Elena Limestones. Rio Grande Village currently gets its water supply from one of these springs. In addition, this same spring and another nearby spring feed two ponds that contain the world's only population of *Gambusia gaigei*.

Outlaw Flats Spring Complex

River miles	748	762
UTM Coordinates N	3292773	3296392
UTM Coordinates E	725582	716672
Zone 13		

Springs issue from the Glen Rose Limestone. Although generally of low volume, there is evidence of historical use at a spring on the Texas side near the confluence with Big Canyon. Historical use includes the remains of a spring box.

Las Palmas Spring Complex

River miles	735	742
UTM Coordinates N	3293228	3293608
UTM Coordinates E	737565	732013
Zone 13		

Large volume springs in Del Carmen Limestone. Historical use at Asa Jones waterworks, a withdrawal and distribution system for a candelilla wax camp located on the canyon rim east of Silver Canyon. The system includes pumps, piping, and several rock tanks, one of which is located over a spring emanating from a rock joint. Park Service personnel estimated the spring discharge at 300 gpm. This joint can be followed in both directions beyond the rock walls where additional water discharges. Water enters the river on both sides along a reach approximately 200 feet long. Undocumented Mexican emigrants use this area frequently, as indicated by the presence of discarded clothing and bedrolls. Directly below the Asa Jones Waterworks, on the Texas side is Spigot Spring. River runners use this spring as a water source. Two miles downstream on the Coahuila Mexico, side is Hot Springs, a very popular river camp due to the presence of several warm pools. A road on the Mexican side provides access to the area for the Mexican Army (reports from River District Ranger). Another spring below and on the Texas side is commonly used as a water source for river runners.

Madison Fold Spring Complex

River miles	720	723
UTM Coordinates N	3298065	3296092
UTM Coordinates E	753147	751786
Zone 13		

Low volume springs discharging from the Del Carmen Limestone and the Maxon Sandstone. As these are the last discharges along the river, river runners commonly use the spring on the Texas side and below Lower Madison Falls as a water source.

GUADALUPE MOUNTAINS NATIONAL PARK SPRINGS COMPLEX

Springs in the Guadalupe Mountains National Park are crucial for maintenance of ecological stability and wildlife health within the Chihuahuan Desert environment. Loss or failure of any of these springs would cause significant environmental stress, even though discharge rates of most are relatively small. Most springs are also historic areas used by pioneers, early ranchers, and settlers. Remains of their homesteads and structures used to manage spring outflow and direct water usage are still visible in and near the springs. The National Park Service is directed to preserve these historic elements and cultural landscapes against unnatural impacts from continued human use, as well as to protect the spring's water quality and quantity from human induced impairment. Specific major natural resource springs are listed in the following table:

SPRINGS IN GUADALUPE MOUNTAINS NATIONAL PARK

Name	Discharge (gpm)	State Well Number	Position NAD 1927 Conus UTM 13 N northing	Position NAD 1927 Conus UTM 13 N easting
Bone Spring	2-3	-	3527444	512087
Dog Canyon Spring	<1	-	3537770	514918
Frijole Spring	6-13	47-02-801	3530009	518842
Goat Spring	1	-	3529611	511370
Guadalupe Spring	6-10	47-02-701	3526606	514633
Juniper Spring	<1	47-02-502	3531081	519488
Manzanita Spring	10-38	47-02-802	3530317	519111
Smith Spring	13-55	47-02-501	3531248	518287
Upper Pine Spring	8-13	47-02-803	3529514	517274

TEXAS NATURE CONSERVANCY INDEPENDENCE CREEK PRESERVE – CAROLINE SPRING

Caroline Spring is located at the Texas Nature Conservancy's Independence Creek Preserve headquarters in northeastern Terrell County. The spring produces 3,000 to 5,000 gallons per minute and comprises about 25 percent of the creek's flow. Downstream, Independence Creek's contribution increases the Pecos River water volume by 42 percent and reduces the total dissolved solids by 50 percent, thus improving water quantity and quality. The preserve hosts a variety of bird and fish species, some of which are extremely rare. Caroline Spring, along with the entirety of the Independence Creek Preserve (19,740 acres), is a significant piece of West Texas natural heritage.

TEXAS NATURE CONSERVANCY DAVIS MOUNTAINS PRESERVE – TOBE, BRIDGE, PINE AND LIMPIA SPRINGS

The wild and remote Davis Mountains is considered one of the most scenic and biologically diverse areas in Texas. Rising above the Chihuahuan desert, the range forms a unique "sky island" surrounded by the lowland desert. Animals and plants living above 5,000 feet are isolated from other similar mountain ranges by vast distances. The Texas Nature Conservancy has established the 32,000-acre Davis Mountains Preserve (with conservation easements on 65,830 acres of adjoining property) in the heart of this region. Tobe, Bridge, Pine and Limpia springs form critical wetland habitat and establish base flow to the downstream creeks.

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CHAPTER 2
POPULATION AND WATER DEMAND

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2 POPULATION AND WATER DEMAND

Planning for the wise use of the existing water resources in Far West Texas requires a reasonable estimation of current and future water needs for all water-use categories. Regional population and water demand data were initially provided to the Far West Texas Water Planning Group (FWTWPG) at the beginning of the planning period. This information incorporated data from the Texas State Data Center and from the U.S. Bureau of the Census' 2010 census count and revised for the 2017 State Water Plan and is presented based on utility service areas. The FWTWPG reviewed the provided projections and concluded that an error and inaccuracy had occurred regarding the TWDB projections of the Town of Anthony. In addition, the mining water demands in both Culberson and Jeff Davis Counties were adjusted to reflect newly granted permit and water use. The revised data was found satisfactory for use in this current regional water plan.

2.1 POPULATION

2.1.1 Population Projection Methodology

County population projections are prepared by the Texas State Data Center / Office of the State Demographer and are based on recent and projected demographic trends, including birth and survival rates and net migration rates of population groups defined by age, gender, and race/ethnicity. Because the fifth cycle of regional water planning falls within an inter-census planning cycle, no new decennial census data is available in time for the use of this Plan. Population projections are therefore based on the 2017 State Water Plan population data.

In addition, population projections and associated water demand projections have been reassembled by utility service areas rather than political boundaries to better plan for the actual water-supply service entity. Previous regional and state water plans have been aligned with political boundaries, such as city limits rather than water utility service areas. Recent TWDB rule changes now define a municipal water user group (WUG) as being utility-based, and thus the emphasis of the development of population and municipal water demands for the 2021 regional water plans transition from political boundaries to utility-service area boundaries.

The projected municipal population is thus allocated to water systems or utilities that provide an average of more than 100 acre-feet per year for municipal use. This newly defined (municipal WUG) includes water systems that vary from privately-owned utilities, systems serving institutions, facilities owned by the state and federal government, and all other retail public utilities that meet the 100-acre feet criteria.

Rural "County Other" population is calculated as the difference between the total projected population of the utility service areas and the total projected county population. Population is then projected from the 2010 base year by decade to the 2070 decade. However, a new set of 2010 population estimates were developed to reflect a utility-based boundary (not political boundary) as a baseline population to be projected for the use of this Plan. A more detailed explanation of the TWDB population projection methodology is available at
http://www.twdb.texas.gov/waterplanning/rwp/planningdocu/2021/doc/current_docs/project_docs/20170405_pop_muni_proj_method_summ.pdf?d=75388.485.

2.1.2 Current and Projected Population

Although the FWTWPG was mandated to use the 2010 census numbers for the purposes of calculating current and projected population, representatives from both urban and rural areas expressed concerns that the census represents a significant undercount of actual residents in the Region. This is especially true in the rural areas, where serious flaws existed with the U.S. Census Bureau's information-gathering techniques.

Current and projected population by decade for water utilities and county rural areas in Far West Texas is listed in Table 2-1. The year-2020 projected population for the entire Region is 954,035 of which 97 percent reside in El Paso County and 77 percent serviced by El Paso Water (Figure 2-1). The regional population is projected to increase to 1,551,438 by the year 2070, which is an increase of 597,403 citizens. Most of this increase (591,775) is projected to occur in El Paso County (Figure 2-2. Population Projection Distribution in El Paso County), while the distribution of projected population in the remaining counties is shown in Figure 2-3.

Table 2-1. Far West Texas Population Projections

	2020	2030	2040	2050	2060	2070
Brewster County - Rio Grande Basin						
Alpine	6,066	6,185	6,231	6,265	6,283	6,293
Lajitas Municipal Services	542	561	568	575	579	579
Marathon Water Supply & Sewer Service	444	460	466	471	474	475
County-Other	2,675	2,885	2,965	3,023	3,051	3,070
Brewster County Total Population	9,727	10,091	10,230	10,334	10,387	10,417
Culberson County - Rio Grande Basin						
Van Horn	2,319	2,542	2,641	2,730	2,782	2,815
County-Other	376	412	428	443	451	457
Culberson County Total Population	2,695	2,954	3,069	3,173	3,233	3,272
El Paso County - Rio Grande Basin						
Anthony	4,206	5,053	5,840	6,620	7,358	8,052
El Paso Water (City of El Paso ***only***)	734,031	822,625	904,900	986,455	1,063,672	1,136,275
El Paso County Tornillo WID	3,202	3,215	3,229	3,242	3,254	3,266
El Paso WCID #4 (Fabens)	8,858	9,131	9,385	9,636	9,874	10,098
East Biggs Water System	11,870	11,870	11,870	11,870	11,870	11,870
Fort Bliss	26,453	27,499	28,471	29,434	30,343	31,200
Horizon Regional MUD	52,993	74,830	95,108	115,207	134,239	152,133
Lower Valley WD (Socorro, Clint, San Elizario)	53,059	63,682	73,546	83,325	92,582	101,287
East Montana Water System	6,599	7,529	8,391	9,247	10,057	10,818
Haciendas Del Norte WID	1,218	1,389	1,548	1,706	1,855	1,996
Paseo Del Este MUD #1	8,116	9,260	10,320	11,372	12,369	13,304
Federal Correctional Institution La Tuna	1,668	1,668	1,668	1,668	1,668	1,668
County-Other	12,061	16,471	20,569	24,630	28,478	32,096
County-Other (Vinton Hills Estates)	370	505	631	756	874	985
County-Other (Vinton Hills Subdivision)	861	1,176	1,469	1,759	2,034	2,292
El Paso County Total Population	925,565	1,055,903	1,176,945	1,296,927	1,410,527	1,517,340
Hudspeth County - Rio Grande Basin						
Hudspeth County WCID #1	952	1,044	1,073	1,095	1,105	1,112
Esperanza Water Service	905	996	1,023	1,043	1,053	1,058
County-Other	553	609	626	638	643	646
County-Other (Dell City)	424	467	480	489	494	496
County-Other (Fort Hancock WCID)	1,079	1,188	1,222	1,246	1,258	1,263
Hudspeth County Total Population	3,913	4,304	4,424	4,511	4,553	4,575
Jeff Davis County - Rio Grande Basin						
Fort Davis WSC	1,361	1,361	1,361	1,361	1,361	1,361
County-Other	839	839	839	839	839	839
County-Other (City of Valentine)	198	198	198	198	198	198
Jeff Davis County Total Population	2,398	2,398	2,398	2,398	2,398	2,398
Presidio County - Rio Grande Basin						
Marfa	2,583	2,807	3,022	3,261	3,473	3,674
Presidio	5,458	5,884	6,297	6,749	7,153	7,538
County-Other	651	754	855	962	1,062	1,155
Presidio County Total Population	8,692	9,445	10,174	10,972	11,688	12,367
Terrell County – Rio Grande Basin						
Terrell County WCID #1	870	890	890	890	890	890
County-Other	175	179	179	179	179	179
Terrell County Total Population	1,045	1,069	1,069	1,069	1,069	1,069
Region E Total Population	**954,035**	**1,086,164**	**1,208,309**	**1,329,384**	**1,443,855**	**1,551,438**

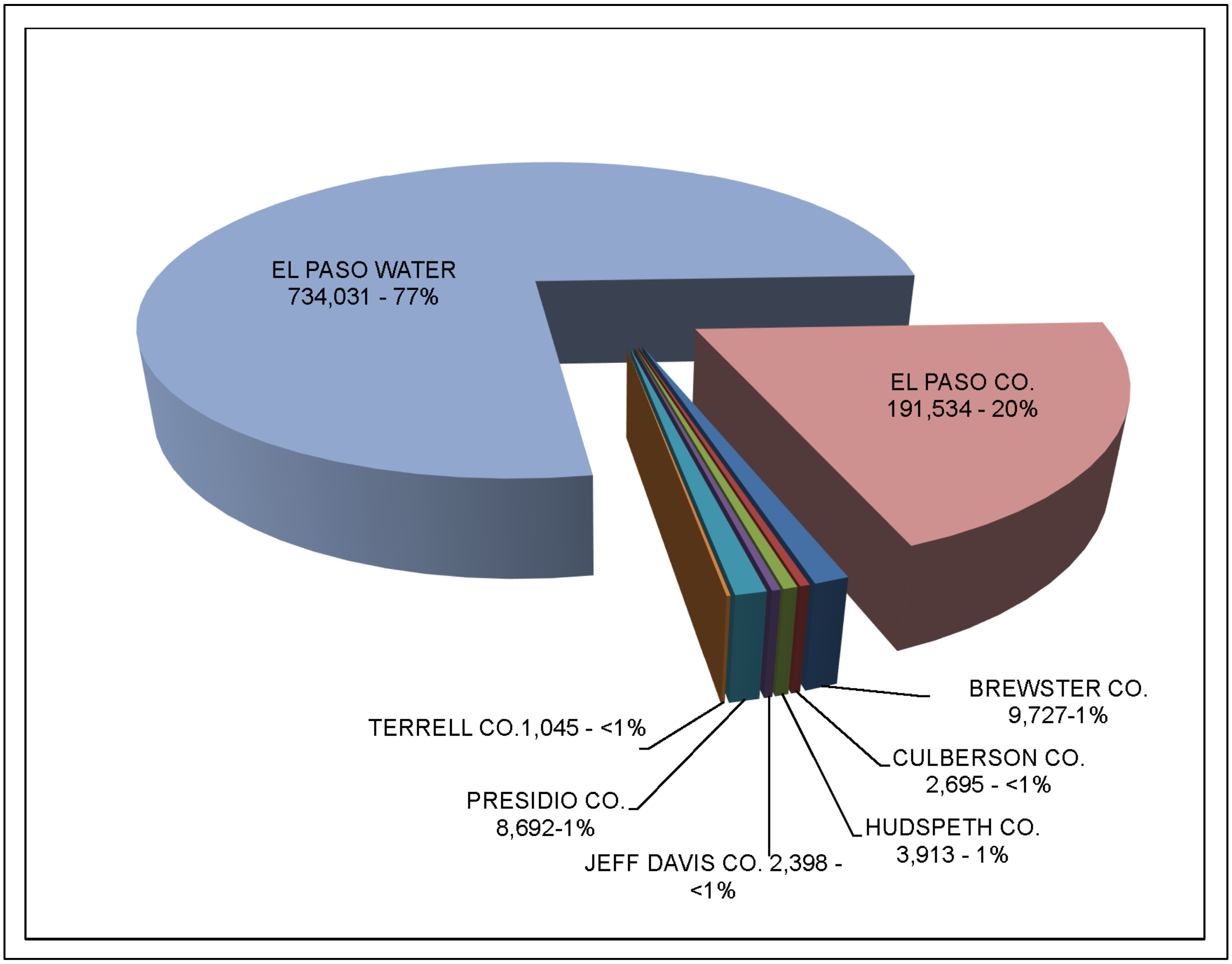

Figure 2-1. Year 2020 Projected Population

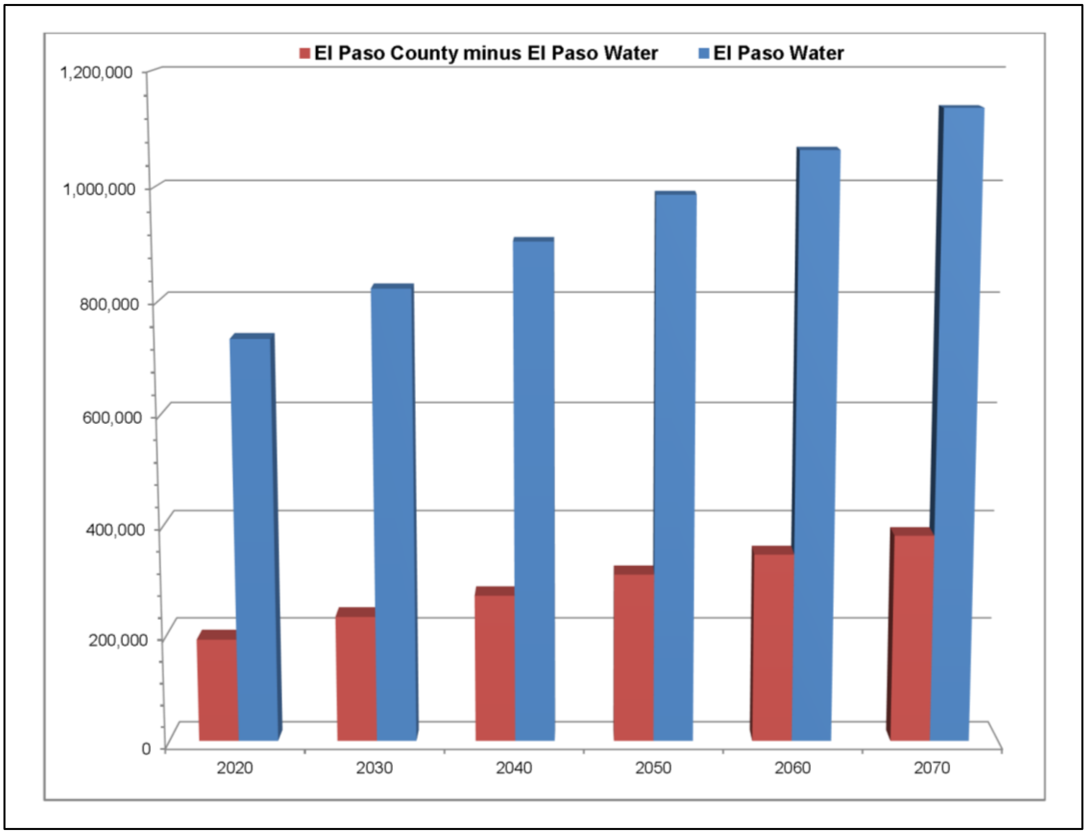

Figure 2-2. Population Projection Distribution in El Paso County

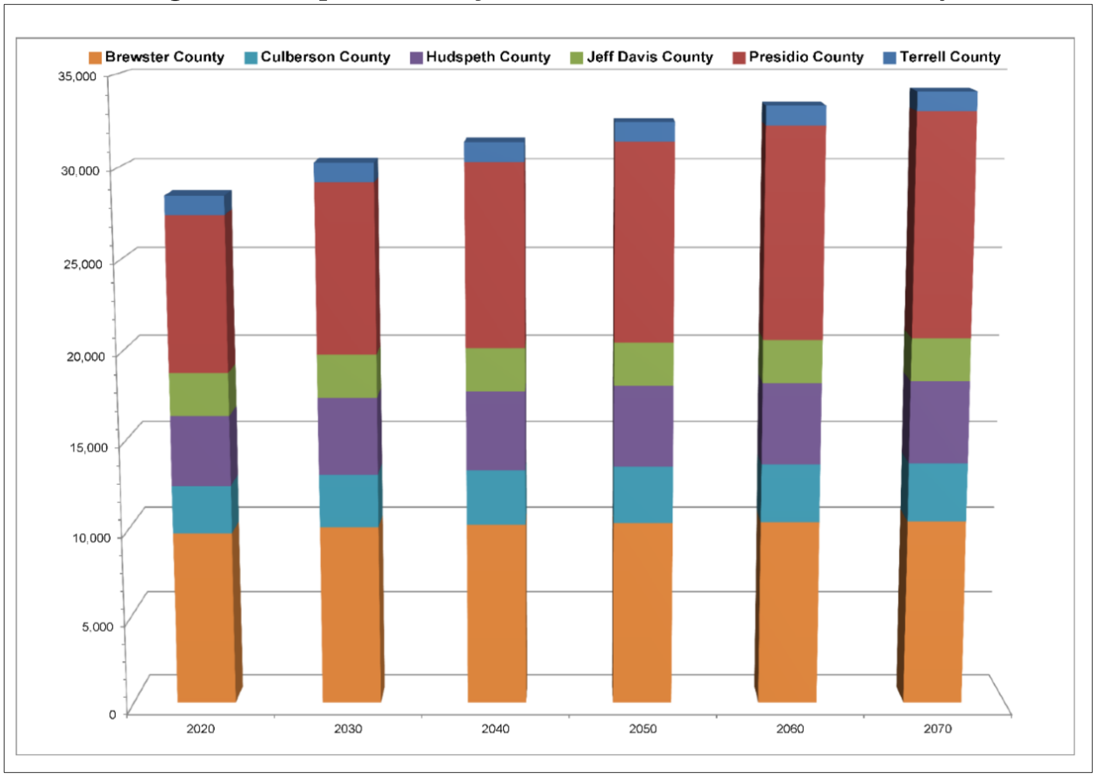

Figure 2-3. Population Projection Distribution in Rural Counties

2.2 WATER DEMAND

A major component of water planning is the establishment of accurate water demand estimates for all water-use categories. Categories of water use include (1) municipal, (2) county-other (rural domestic), (3) manufacturing, (4) irrigation, (5) steam-electric power generation, (6) livestock, and (7) mining. Individual municipal utility-based are further identified as Water User Groups (WUGs).

In early 2016, the TWDB contracted CDM Smith to review the projection methodologies previously used, provide insight on how projections were developed in other state planning efforts, and recommend alternative methodologies. The TWDB determined that the water demand projections methodologies for three of the categories – manufacturing, irrigation and steam-electric power – should be revised to better reflect reported historical water use. Summaries of the methodologies are included below in Sections 2.2.3 – 2.2.5. A more descriptive report can be found here: http://www.twdb.texas.gov/waterplanning/rwp/planningdocu/2021/current_docs.asp. Regardless of methodologies, the planning group anticipates that water demand is likely underestimated and, therefore, an emphasis is being made in this planning document to recognize a need for more water than is justified simply from the population-derived water demand quantities.

Table 2-2 lists the current and future projected regional water demands by county and water-use category. The percent distribution of year-2020 projected water demand in the Region by the seven water-use categories is shown in Figure 2-4 and by county in Figure 2-5. Of particular concern to the FWTWPG in Table 2-2 is the demand projections for the Irrigation category in El Paso County, which is discussed in the following Section 2.2.4.

Other water use categories that are not quantified in this *Plan* but are addressed (Section 2.3) include environmental and recreational needs. An additional use that is not quantified but may be of significance is water that is used in road construction for both compaction and dust suppression.

Figure 2-6 illustrates current and future projected regional water demand estimates by water-use category, while Figure 2-7 illustrates water demand projections by county. For the 2020 to 2070 decades the total water demand in the Region is projected to increase from 480,424 to 559,976 acre-feet per year.

The potential role of conservation is an important factor in projecting future water supply requirements. In this *2021 Plan*, conservation is included in the municipal projections as a measure of expected savings based on requirements of the State plumbing code. All other conservation practices are discussed in terms of water supply strategies in Chapter 5 and as a component of drought management plans in Chapter 7.

The planning group feels that conservation savings reduction to future water demands should not be imposed on rural entities. Counties have not historically been granted significant rule-making authority as compared to municipalities. As such, water-supply districts which are located wholly or primarily in unincorporated communities do not have the same potential to reduce consumption through conservation efforts, given that many of these efforts are established through a municipality's ordinances and/or subdivision standards/codes. Without a statutory mechanism affording counties, or water districts serving unincorporated areas, additional rule-making authority, conservation savings will be very difficult to reach in these communities.

The following sections present an overview of water supply needs for major water providers and for each of the seven-designated water-use categories and include methods and assumptions used in the State's consensus water planning process.

Table 2-2. Far West Texas Water Demand Projections (Rio Grande River Basin)
(Acre-Feet per Year)

	2020	2030	2040	2050	2060	2070
Brewster County						
Alpine	1,934	1,944	1,935	1,933	1,937	1,940
Lajitas Municipal Services	103	104	103	103	104	104
Marathon Water Supply & Sewer Service	124	126	126	127	127	127
County-Other	411	431	433	436	439	442
Livestock	347	347	347	347	347	347
Irrigation	2,006	2,006	2,006	2,006	2,006	2,006
Brewster County Total Demand	4,925	4,958	4,950	4,952	4,960	4,966
Culberson County						
Van Horn	662	711	737	760	774	783
County-Other	65	69	71	73	74	75
Manufacturing	5	6	6	6	6	6
Mining	2,119	2,853	3,006	2,723	2,456	2,253
Livestock	270	270	270	270	270	270
Irrigation	37,863	37,863	37,863	37,863	37,863	37,863
Culberson County Total Demand	40,984	41,772	41,953	41,695	41,443	41,250
El Paso County						
Anthony	770	905	1,033	1,163	1,291	1,412
El Paso Water (City of El Paso ***only***)	110,572	120,315	129,713	139,978	150,601	160,792
El Paso County Tornillo WID	320	312	306	303	303	304
El Paso WCID #4 (Fabens)	810	793	781	783	798	816
East Biggs Water System	798	798	798	798	798	798
Fort Bliss	4,881	4,921	5,024	5,182	5,331	5,481
Horizon Regional MUD	7,936	11,043	13,962	16,868	19,630	22,235
Lower Valley WD (Socorro, Clint, San Elizario)	5,714	6,563	7,398	8,290	9,189	10,045
East Montana Water System	806	891	974	1,064	1,155	1,241
Haciendas Del Norte WID	196	218	240	262	285	306
Paseo Del Este MUD #1	1,054	1,167	1,278	1,397	1,515	1,629
Federal Correctional Institution La Tuna	352	345	342	340	339	339
County-Other	2,086	2,758	3,395	4,055	4,680	5,272
County-Other (Vinton Hills Estates)	64	85	104	124	144	162
County-Other (Vinton Hills Subdivision)	149	197	242	290	334	376
Manufacturing	7,028	8,157	8,157	8,157	8,157	8,157
Mining	4,008	4,626	5,262	5,948	6,693	7,539
Steam Electric Power	10,545	10,545	10,545	10,545	10,545	10,545
Livestock	171	171	171	171	171	171
Irrigation	149,570	149,570	149,570	149,570	149,570	149,570
El Paso County Total Demand	307,830	324,380	339,295	355,288	371,529	387,190
Hudspeth County						
Hudspeth County WCID #1	142	151	152	153	154	155
Esperanza Water Service	142	152	153	154	155	156
County-Other	58	61	61	61	61	62
County-Other (Dell City)	45	47	47	47	47	47
County-Other (Fort Hancock WCID)	114	119	119	119	120	121
Mining	479	451	468	483	492	502
Livestock	437	437	437	437	437	437

Table 2-2. (continued) Far West Texas Water Demand Projections (Rio Grande River Basin)
(Acre-Feet per Year)

	2020	2030	2040	2050	2060	2070
Hudspeth County						
Irrigation	115,542	115,542	115,542	115,542	115,542	115,542
Hudspeth County Total Demand	116,959	116,960	116,979	116,996	117,008	117,022
Jeff Davis County						
Fort Davis	319	314	309	307	307	307
County-Other	124	120	117	115	115	115
County-Other (City of Valentine)	29	28	28	27	27	27
Mining	153	153	153	153	153	153
Livestock	397	397	397	397	397	397
Irrigation	665	665	665	665	665	665
Jeff Davis County Total Demand	1,687	1,677	1,669	1,664	1,664	1,664
Presidio County						
Marfa	690	735	781	841	895	947
Presidio	738	772	808	856	905	953
County-Other	100	112	123	139	153	166
Mining	403	0	0	0	0	0
Livestock	328	328	328	328	328	328
Irrigation	4,006	4,006	4,006	4,006	4,006	4,006
Presidio County Total Demand	6,265	5,953	6,046	6,170	6,287	6,400
Terrell County						
Terrell County WCID #1	178	178	178	177	177	177
County-Other	21	21	20	20	20	20
Mining	673	776	740	606	483	385
Livestock	151	151	151	151	151	151
Irrigation	751	751	751	751	751	751
Terrell County Total Demand	1,774	1,877	1,840	1,705	1,582	1,484
Region E Total Water Demand	**480,424**	**497,577**	**512,732**	**528,470**	**544,473**	**559,976**

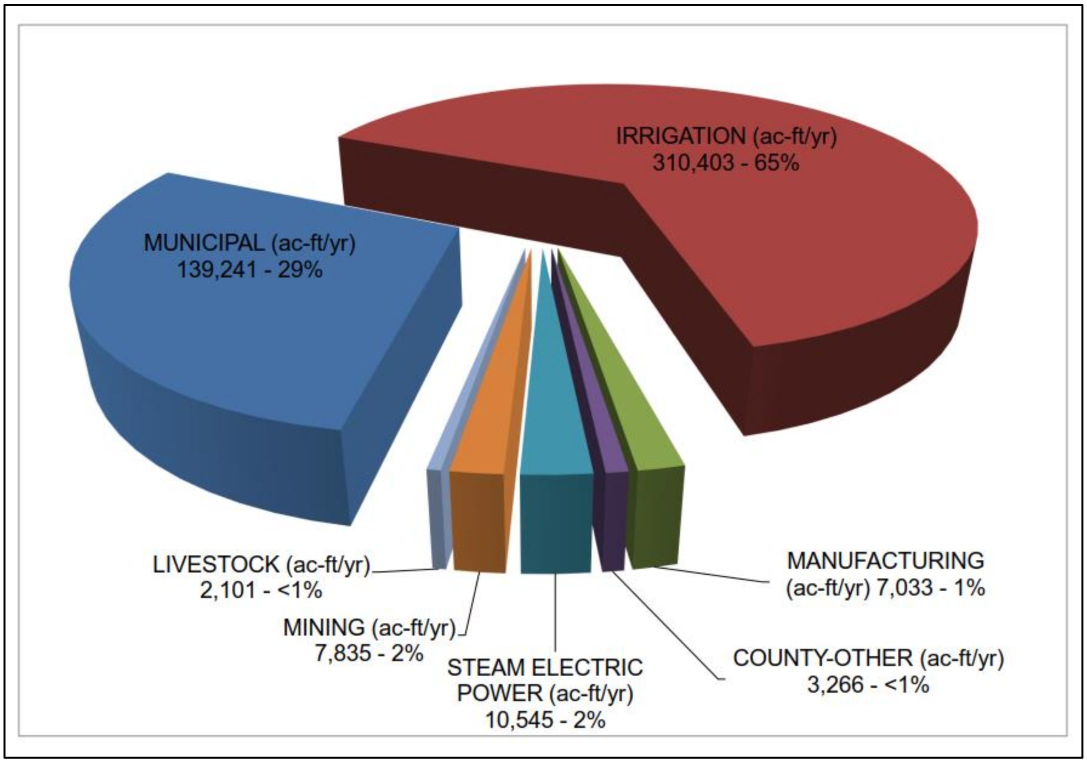

Figure 2-4. Year 2020 Projected Water Demand by Water Use Category

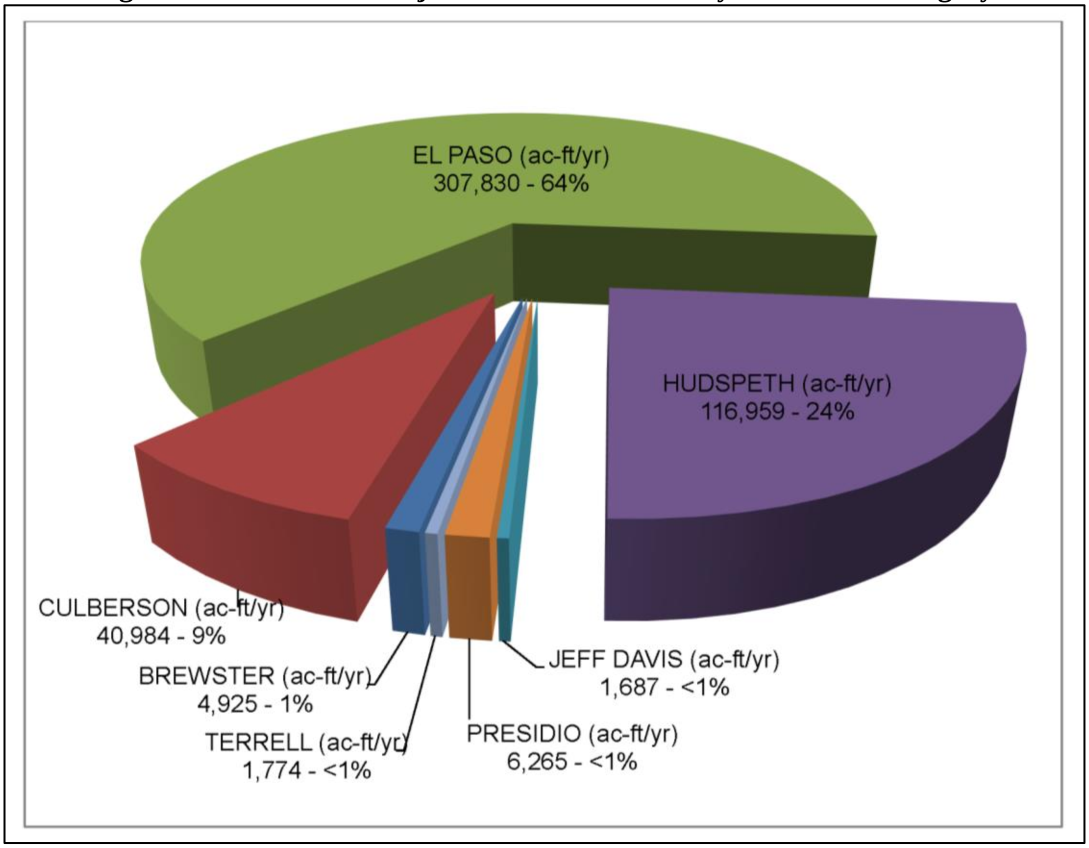

Figure 2-5. Year 2020 Projected Water Demand by County

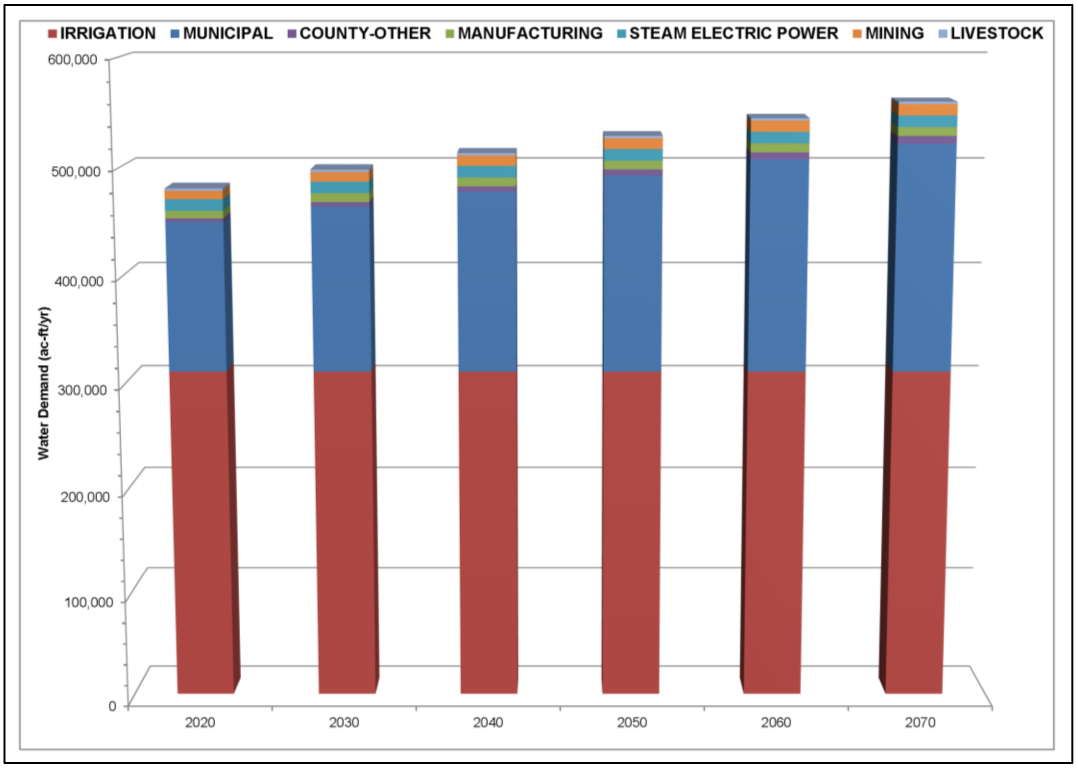

Figure 2-6. Regional Projected Water Demand by Water Use Category

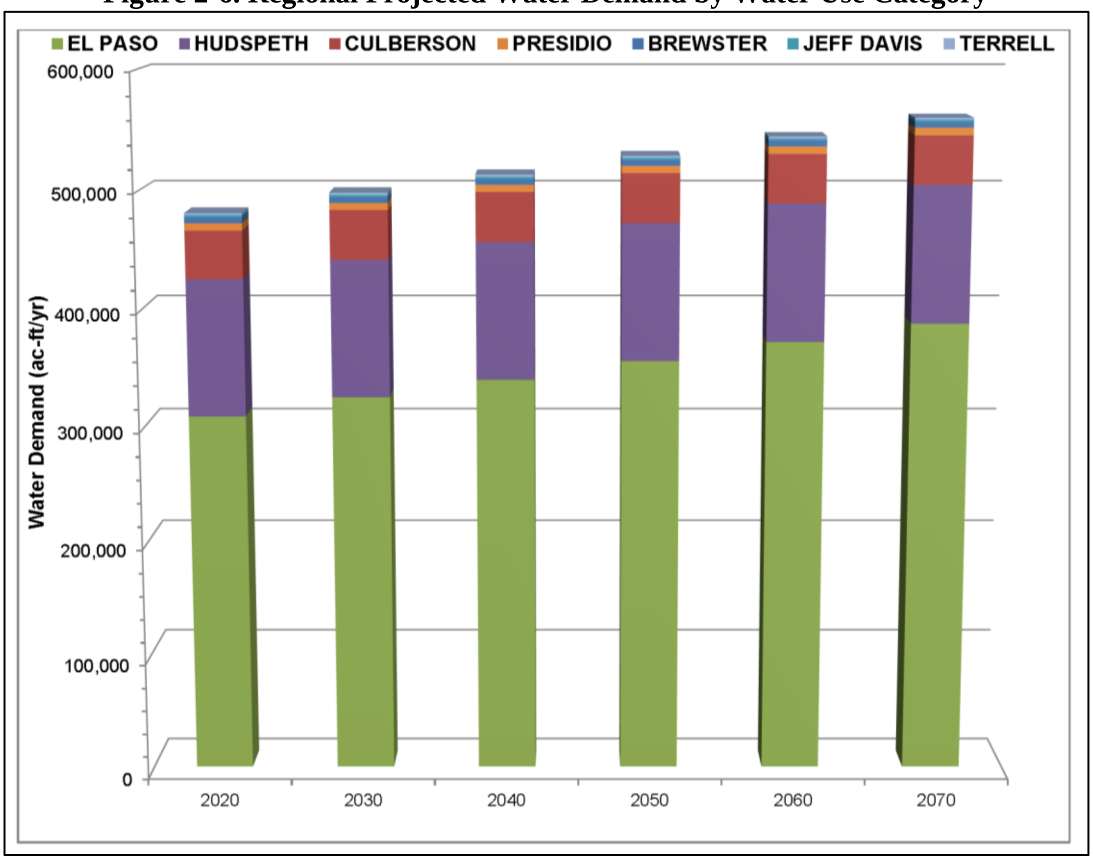

Figure 2-7. Regional Projected Water Demand by County

2.2.1 Major Water Providers

Recent TWDB rule changes have revised 31TAC §357.30(4), which now requires regional water planning groups to identify "major water providers" as opposed to "wholesale water providers" as performed in previous plans. A major water provider (MWP) is defined as a significant public or private WUG or wholesale water provider (WWP) whose significance is determined by the RWPG and provides water for any water use category in a regional water planning area. This rule revision gives regional water planning groups more flexibility in identifying which large water providers ought to be reported in their regional water plans.

The Far West Texas Planning Group has developed and adopted the following definition of a MWP, and feels that this definition captures all significant municipal WUGs or WWPs that provide water for other water use categories within the Region:

> *"An entity that currently provides significant water supplies (>5,000 acre-feet per year) to other users and which will continue to develop new supplies to meet future needs of those whom they supply during the period covered by this Plan*."

Table 2-3 lists the water demand for the major water providers in the Region and their customers.

Table 2-3. Far West Texas Major Water Provider Water Demand

Major Water Provider	Receiving Entity	Water Demand (Acre-Feet/Year)					
		2020	2030	2040	2050	2060	2070
El Paso County WID#1	El Paso Water (33% of total demand)	49,358	49,358	49,358	49,358	49,358	49,358
	El Paso County Irrigation	100,212	100,212	100,212	100,212	100,212	100,212
	Total Demand	**149,570**	**149,570**	**149,570**	**149,570**	**149,570**	**149,570**
El Paso Water	City of El Paso	110,572	120,315	129,713	139,978	150,601	160,792
	Fort Bliss (25% of total demand)	1,420	1,430	1,456	1,495	1,532	1,570
	Lower Valley Water District	5,714	6,563	7,398	8,290	9,189	10,045
	Vinton	213	282	346	414	478	538
	Paseo Del Este MUD #1	1,054	1,167	1,278	1,397	1,515	1,629
	East Montana Water System	806	891	974	1,064	1,155	1,241
	Haciendas Del Norte WID	196	218	240	262	285	306
	Manufacturing	7,028	8,157	8,157	8,157	8,157	8,157
	Mining (12% of total demand)	481	555	631	714	803	905
	Steam Electric Power (75% of total demand)	7,909	7,909	7,909	7,909	7,909	7,909
	County Other	2,086	2,758	3,395	4,055	4,680	5,272
	Total Demand	**137,479**	**150,245**	**161,497**	**173,735**	**186,304**	**198,364**
Lower Valley Water District	Socorro	2,686	2,888	3,107	3,316	3,584	3,818
	Clint	57	66	74	83	92	100
	San Elizario	2,971	3,610	4,217	4,891	5,513	6,127
	Total Demand	**5,714**	**6,563**	**7,398**	**8,290**	**9,189**	**10,045**
Horizon Regional MUD	Horizon City	4,351	6,149	7,836	9,514	11,108	12,610
	Other Retail Customers	3,585	4,894	6,126	7,354	8,522	9,625
	Total Demand	**7,936**	**11,043**	**13,962**	**16,868**	**19,630**	**22,235**

2.2.2 Municipal and County-Other

The quantity of water used for municipal and county-other (rural domestic) purposes is heavily dependent on population, climatic conditions, and water-conservation measures. For planning purposes, municipal water use comprises both residential and commercial. Commercial water use includes business establishments, public offices, and institutions. Residential and commercial uses are categorized together because they are similar types of uses i.e., they both use water primarily for drinking, cleaning, sanitation, air conditioning, and landscape watering. Also included in this category is water applied to municipally owned golf courses. Water use within a utility service area that is not included in the quantification of municipal demand is that used in self-supplied manufacturing and industrial processes.

Municipal and county-other water demand is calculated based on utility service boundaries designated in the population projections process and include rural domestic use. Projected municipal water demand is based on the year-2010 per-capita water use, which is calculated with year-2010 population counts divided into reported water use for the same year. Per-capita water use in communities with significant non-residential water demands, such as for commercial customers, will appear abnormally high. The year-2010 per-capita water use is reduced slightly over time to simulate expected conservation savings due to state-mandated plumbing code implementation. Table 2-4 presents municipal savings due to the natural installation of plumbing fixtures and appliances to more water-efficient fixtures and appliances. The conservation adjusted per-capita water use is then applied to each of the decade population estimates to produce the projected water demand for each entity. Table 2-5 presents the municipal and county-other projected water use for each decade in the current planning cycle.

Rural communities (outside of El Paso County) are relatively small and are generally reliant on self-provided water supplies. Water demand within these communities is related directly to their population trends and is thus relatively stable or moderately increasing over the next 50 years. Projected water-demand growth for the numerous communities within El Paso County is significantly greater and thus will require a level of coordinated intercommunity planning.

Table 2-4. Municipal Savings Due to Plumbing Fixture Requirements
(Acre-Feet per Year)

County	Entity Name	2020	2030	2040	2050	2060	2070
Brewster	Alpine	63	93	117	130	133	133
Brewster	Lajitas Municipal Services	6	8	11	12	12	12
Brewster	Marathon Water Supply & Sewer Services	5	7	9	10	10	10
Brewster	County-Other	29	44	55	61	63	63
Culberson	Van Horn	29	47	50	53	55	55
Culberson	County-Other	4	6	8	9	9	9
El Paso	Anthony	45	74	99	120	135	148
El Paso	El Paso Water	7,828	12,375	16,248	19,138	20,970	22,490
El Paso	El Paso County Tornillo WID	28	38	45	50	51	51
El Paso	El Paso WCID #4	93	138	176	200	208	213
El Paso	East Biggs Water System	99	99	99	99	99	99
El Paso	Fort Bliss Water Services	304	469	557	588	617	635
El Paso	Horizon Regional MUD	434	775	1059	1328	1571	1793
El Paso	Lower Valley Water District	645	1,069	1,417	1,697	1,907	2,094
El Paso	East Montana Water System	66	104	134	157	174	188
El Paso	Haciendas Del Norte WID	12	19	25	29	32	35
El Paso	Paseo Del Este MUD #1	81	128	165	193	214	231
El Paso	Federal Correctional Institution La Tuna	17	23	27	28	29	29
El Paso	County-Other	158	316	448	548	643	727
Hudspeth	Hudspeth County WCID #1	11	17	20	23	23	23
Hudspeth	Esperanza Water Service	10	16	20	22	22	22
Hudspeth	County-Other	23	36	44	49	50	51
Jeff Davis	Fort Davis	13	19	23	25	26	26
Jeff Davis	County-Other	11	16	20	22	22	22
Presidio	Marfa	31	48	62	68	74	78
Presidio	Presidio	56	85	109	127	137	144
Presidio	County-Other	8	13	17	20	22	24
Terrell	Terrell County WCID #1	11	15	16	16	16	16
Terrell	County-Other	2	3	3	3	3	3
Total		**10,120**	**16,098**	**21,081**	**24,820**	**27,324**	**29,425**

Table 2-5. Municipal and County-Other Water Demand Projections - Rio Grande Basin
(Acre-Feet per Year)

	2020	2030	2040	2050	2060	2070
Brewster County						
Alpine	1,934	1,944	1,935	1,933	1,937	1,940
Lajitas Municipal Services	103	104	103	103	104	104
Marathon Water Supply & Sewer Service	124	126	126	127	127	127
County-Other	411	431	433	436	439	442
Brewster County Total Demand	**2,572**	**2,605**	**2,597**	**2,599**	**2,607**	**2,613**
Culberson County						
Van Horn	662	711	737	760	774	783
County-Other	65	69	71	73	74	75
Culberson County Total Demand	**727**	**780**	**808**	**833**	**848**	**858**
El Paso County						
Anthony	770	905	1,033	1,163	1,291	1,412
El Paso Water	110,572	120,315	129,713	139,978	150,601	160,792
El Paso County Tornillo WID	320	312	306	303	303	304
El Paso WCID #4	810	793	781	783	798	816
East Biggs Water System	798	798	798	798	798	798
Fort Bliss	4,881	4,921	5,024	5,182	5,331	5,481
Horizon Regional MUD	7,936	11,043	13,962	16,868	19,630	22,235
Lower Valley WD	5,714	6,563	7,398	8,290	9,189	10,045
East Montana Water System	806	891	974	1,064	1,155	1,241
Haciendas Del Norte WID	196	218	240	262	285	306
Paseo Del Este MUD #1	1,054	1,167	1,278	1,397	1,515	1,629
Federal Correctional Institution La Tuna	352	345	342	340	339	339
County-Other	2,086	2,758	3,395	4,055	4,680	5,272
County-Other (Vinton Hills Estates)	64	85	104	124	144	162
County-Other (Vinton Hills Subdivision)	149	197	242	290	334	376
El Paso County Total Demand	**136,508**	**151,311**	**165,590**	**180,897**	**196,393**	**211,208**
Hudspeth County						
Hudspeth County WCID #1	142	151	152	153	154	155
Esperanza Water Service	142	152	153	154	155	156
County-Other	58	61	61	61	61	62
County-Other (Dell City)	45	47	47	47	47	47
County-Other (Fort Hancock WCID)	114	119	119	119	120	121
Hudspeth County Total Demand	**501**	**530**	**532**	**534**	**537**	**541**
Jeff Davis County						
Fort Davis	319	314	309	307	307	307
County-Other	124	120	117	115	115	115
County-Other (City of Valentine)	29	28	28	27	27	27
Jeff Davis County Total Demand	**472**	**462**	**454**	**449**	**449**	**449**
Presidio County						
Marfa	690	735	781	841	895	947
Presidio	738	772	808	856	905	953
County-Other	100	112	123	139	153	166
Presidio County Total Demand	**1,528**	**1,619**	**1,712**	**1,836**	**1,953**	**2,066**
Terrell County						
Terrell County WCID #1	178	178	178	177	177	177
County-Other	21	21	20	20	20	20
Terrell County Total Demand	**199**	**199**	**198**	**197**	**197**	**197**
Region E Total Municipal Water Demand	**142,507**	**157,506**	**171,891**	**187,345**	**202,984**	**217,932**

<u>El Paso County Tornillo WID:</u> While Tables 2-1 and 2-5 list TWDB approved population and water demand projections, Table 2-6 provides a self-evaluated perspective by El Paso County Tornillo WID based on more recent population and water use data. The Water Planning Group recognizes that these projections for Tornillo are likely more accurate than those based on the 2010 census required as a basis for this *Plan* and, thus desire to present this alternative for the community in this current *Plan*.

Table 2-6. El Paso County Tornillo WID Proposed Alternative Population and Water Demand Projections

El Paso County Tornillo WID	2020	2030	2040	2050	2060	2070
Population	21	21	20	20	20	20
Water Demand (acre-feet per year)	199	199	198	197	197	197

<u>East Montana Water System:</u> The County of El Paso has operated the East Montana Water System since it acquired eight independent water systems in the East Montana area in 1996. The water is purchased through a wholesale water agreement from El Paso Water and currently has a capacity of 2,200 connections. The system is nearing its capacity, due to design standards used in constructing eight various smaller systems and not one single-large system. There are currently 3,259 lots within the service area of the system with an identified 1,371 lots needing water connections. In June 2017, the County calculated there were only an available 528 meters to distribute to the public and subsequently adopted a "Water Meter Allocation Policy" which limited meters to:

- No Larger than ¾ inch
- Meters only for single-family residential lots established on or before May 12, 1997
- One meter per single-family residential lot

Additionally, the policy requires that any future subdivisions or projects submitted after March 7, 2016 submit a water supply agreement from a supplier other than the East Montana Water System unless service has been committed and an agreement is pending in County Public Works. In sum, the system is limited in its ability to grow without significant investment in capacity-related improvements. With that context, the East Montana Water System contends that the population and water demand projections shown in Tables 2-1 and 2-2 are significantly exaggerated as they do not account for the fact that the system is at 80 percent capacity.

A significant portion of the municipal water demand in Brewster, Jeff Davis, and Presidio Counties is assigned to the county-other (rural) category. This category represents the aggregation of utilities that provide less than an average of 100 acre-feet per year, as well as rural areas not served by a water utility in each county. Table 2-7 presents a listing of water systems that comprise the county-other category along with the corresponding annual water use survey data (2010-2015).

A water user group within county-other can be further divided into a "sub-WUG" at the discretion of the planning group for a more detailed analysis. This option allows for a higher resolution in water needs analyses to better account for present water supplies and needs within certain county-other systems of interest, which would otherwise be aggregated at the county level. Table 2-7 indicates in italics the water systems that the Far West Texas Water Planning Group designated as official sub-WUGs.

Table 2-7. County-Other Systems Reported Water Use From 2010 through 2015
(Acre-Feet per Year)

	2010	2011	2012	2013	2014	2015
Brewster County-Other						
Study Butte Terlingua Water System	32	81	119	119	90	106
Panther Junction BBNP	36	26	21	21	23	23
Chisos Basin Water BBNP	16	14	14	16	16	16
Rio Grande Village BBNP	2	5	10	11	14	14
Castolon Maintenance Area BBNP	2	3	2	1	1	1
* Big Bend Resort & Adventures	-	-	-	-	-	-
Brewster County-Other Total Water Use	**88**	**129**	**166**	**168**	**144**	**160**
Culberson County-Other						
Pine Springs GMNP	18	18	20	23	28	0
* TX Dot Culberson County SRA US 62	-	-	-	-	-	-
* TX Dot Culberson County SRA IH 10	-	-	-	-	-	-
Culberson County-Other Total Water Use	**18**	**18**	**20**	**23**	**28**	**0**
El Paso County-Other						
Ponderosa and Western Village WSC	0	77	77	77	77	77
Vinton Hills Subdivision	69	77	76	72	76	75
Vinton Village Estates	37	39	38	38	33	32
River View Estates	28	26	25	30	30	24
Green Acres Mobile Home Park	0	0	0	0	0	21
Villa Alegre Estates	11	11	11	10	9	9
Valley Acres Mobile Home Park Water System	2	3	3	3	0	0
Fort Bliss Site Monitor	6	0	0	0	0	0
Hueco Tanks State Park TPWD	2	2	2	0	0	0
* Hillside Water Works	-	-	-	-	-	-
* Chamizal National Memorial	-	-	-	-	-	-
* East Montana Location	-	-	-	-	-	-
* Hueco Club	-	-	-	-	-	-
El Paso County-Other Total Water Use	**155**	**235**	**232**	**230**	**225**	**238**
Hudspeth County-Other						
Fort Hancock WCID	76	76	70	84	82	80
Dell City	52	55	57	63	63	63
Cerro Alto Water System	0	0	0	0	0	8
Hudspeth County-Other Total Water Use	**128**	**131**	**127**	**147**	**145**	**151**
Jeff Davis County-Other						
City of Valentine	29	32	29	21	19	19
Fort Davis Estates	0	11	10	8	9	7
UT McDonald Observatory	13	18	16	0	12	0
TPWD Davis Mountains State Park Campground	23	22	23	22	24	0
Fort Davis National Historic Site	0	18	0	0	14	0
Jeff Davis County-Other Total Water Use	**65**	**69**	**78**	**51**	**27**	**26**
Presidio County-Other						
Candelaria WSC	4	4	4	4	4	4
* Big Bend Ranch State Park TPWD	-	-	-	-	-	-
* Redford Water Supply	-	-	-	-	-	-
Presidio County-Other Total Water Use	**4**	**4**	**4**	**4**	**4**	**4**
Terrell County-Other						
(No Data Provided by the TWDB)	-	-	-	-	-	-
Region E Total Water Use	**458**	**586**	**627**	**623**	**573**	**579**

*No survey data provided

2.2.3 Manufacturing

Manufacturing self-supplied water demand projections are based on the highest county-aggregated manufacturing water use in the most recent five-years (2010-2015) of reported annual water use survey data. The most recent 10-year projections for employment growth from the Texas Workforce Commission was used as proxy for growth by manufacturing sectors between 2020 and 2030. After 2030, the manufacturing water use was held constant through 2070.

The use of water for manufacturing purposes only occurs in, Culberson, and El Paso Counties (Table 2-8). Use in Culberson County is minimal and is not anticipated to change significantly over time, however, manufacturing water use in El Paso County is expected to increase from 7,028 acre-feet in the year 2020 to 8,157 acre-feet by 2070.

Table 2-8. Manufacturing Water Use Projections
(Acre-Feet per Year)

County	2020	2030	2040	2050	2060	2070
Brewster	0	0	0	0	0	0
Culberson	5	6	6	6	6	6
El Paso	7,028	8,157	8,157	8,157	8,157	8,157
Hudspeth	0	0	0	0	0	0
Jeff Davis	0	0	0	0	0	0
Presidio	0	0	0	0	0	0
Terrell	0	0	0	0	0	0

2.2.4 Irrigation

Irrigation water demand projections utilize an average of TWDB's 2010-2015 irrigation water use estimates as a base. Those values were then held constant between 2020 and 2070. Annual water use estimates are developed at the county level by applying a calculated evapotranspiration-based "crop water need" estimate to reported irrigated acreage from Farm Service Agency (FSA). These estimates are then adjusted based on surface water release data from TCEQ and Texas Water Masters and comments from Groundwater Conservation Districts. In counties where the total groundwater availability over the planning period is projected to be less than the groundwater portion of the baseline water demand projections, the irrigation water demand projections will begin to decline in 2030 or later, to be compatible with the groundwater availability. However, this approach to a 'groundwater constrained' area presently does not occur in the Far West Texas Region.

Tables 2-2 and 2-9 include a value of 149,570 acre-feet per year as estimated irrigation water demand for El Paso County, but the value is based on historical water use during an extreme drought. The accurate estimate, instead, is the one included in the Water Demand Projection in Table 2-2 of the 2016 Far West Texas Water Plan, showing estimated irrigation water demand of 242,798 acre-feet per year based on years with an adequate supply of surface water. The latter value is more accurate than the former value because the methodology used by TWDB for Table 2-2, as documented in the February 2017 TWDB Water Demand Project Methodologies report, uses average irrigation water use over the most recent five years (2010-2014), instead of during a period of adequate surface water supply, as the basis for estimating future surface water irrigation demands in El Paso and Hudspeth Counties.

Statewide, irrigation water demands are expected to decline over time. More efficient canal delivery systems have improved water-use efficiencies of surface water irrigation. More efficient on-farm irrigation systems have also improved the efficiency of groundwater irrigation. Other factors that have contributed to decreased irrigation demands are declining groundwater supplies and the voluntary transfer of water rights historically used for irrigation to municipal uses.

Water used for agricultural irrigation in Far West Texas is significantly greater (65 percent of total) than all other water-use categories. On a regional basis, water used for the irrigation of crops is projected to remain steady over the 50-year planning horizon. However, as any irrigator can attest, climate, water availability, and the market play key roles in how much water is actually applied on a year-by-year basis.

The quantity and quality of water needed for agricultural irrigation is dependent on the type of crop grown and on soil characteristics. Although a minimal amount of agriculture can persist on limited water supplies, most crops require significantly larger water applications to remain profitable. Irrigated farms along the Rio Grande corridor in El Paso and Hudspeth Counties are almost entirely dependent on water supplies derived from the River. When Rio Grande water is limited or not available, most farming temporarily ceases until water supplies once again become available. Irrigated farms in other areas within the Region are dependent on groundwater supplies. Availability of these supplies depends on local pumping regulatory limitations, aquifer hydrologic characteristics, and energy cost.

Irrigation strategies principally involve various forms of conservation. Irrigation application equipment has been developed to ensure that greater amounts of applied water reach the root system while minimizing loss to evaporation. Proper application timing is also critical in avoiding over-watering. The lining of canals that transport water from its source to the fields reduces losses due to seepage. Drought tolerant crop selection is also important when faced with limited water supplies.

Some farmers across the Region are using slightly-saline water for irrigation. To maintain long-term soil productivity with saline waters, producers must over irrigate to maintain a leaching fraction that minimizes salt buildup in the crop root zone. In some areas, high levels of sodium have reduced soil infiltration rates. Producers often manage this problem through application of soil amendments (such as gypsum or organic residues) or through mechanical mixing of the soil. Table 2-9 presents the projected irrigation water use for all decades in the current water planning cycle.

Table 2-9. Irrigation Water Use Projections
(Acre-Feet per Year)

County	2020	2030	2040	2050	2060	2070
Brewster	2,006	2,006	2,006	2,006	2,006	2,006
Culberson	37,863	37,863	37,863	37,863	37,863	37,863
El Paso	149,570	149,570	149,570	149,570	149,570	149,570
Hudspeth	115,542	115,542	115,542	115,542	115,542	115,542
Jeff Davis	665	665	665	665	665	665
Presidio	4,006	4,006	4,006	4,006	4,006	4,006
Terrell	751	751	751	751	751	751

2.2.5 Steam Electric Power Generation

Steam-electric power water use is influenced by a variety of factors, including fuel prices, weather conditions, electricity demand, the cooling design of the facilities, and others. As part of this planning cycle, the draft steam-electric power generation water demand projections in 2020 are based on the highest county-aggregated water use in the most recent five-years (2010-2015) of water use estimates. The anticipated water-use of future facilities listed in the state and federal reports was added to the demand projections from the anticipated operation date to 2070. Likewise, the reported water-use of facilities scheduled for retirement was subtracted from the demand projections.

In previous plans, the volumes of reuse water, such as treated effluent, used by generating facilities have not been included in the historic water use estimates or the water demand projections. However, reuse is becoming an increasingly valuable water supply state-wide, and is an important part of meeting future water demands. In recognition of this critical water supply component, the TWDB for this planning cycle has developed the steam-electric water demand projections to include the relevant reuse volumes reported by the power facilities in both the 2021 regional water plans and the 2022 State Water Plan.

El Paso Electric (EPE) located in El Paso County is the only facility within the Region that uses water in the form of steam to generate electricity. Currently, EPE operates four different electric-generating stations, distributing electricity across a 10,000-square mile service area in the Rio Grande Valley of west Texas and south-central New Mexico. These stations are comprised of a variety of different electric generation technology systems (e.g. steam turbine, gas turbine, combined cycle, etc.) as well as having various cooling systems (once-through, cooling tower). These different generation technologies require various volumes of water use. EPE recommends that in addition to fuel type, the TWDB's methodology also considers the type of generation technology system as another significant component of water consumption rate.

Electricity demands within the Region are likely to increase due to anticipated local population growth, as well as increasing commercial and manufacturing power needs. However, anticipated improvements and shifts in generation technologies and water conservation strategies may offset consumptive water use for steam-electric generation, resulting in a static projection for water demand across the planning horizon.

Table 2-10 presents the steam-electric power water demand projections. The only steam-electric power water use in the Region is within El Paso County. El Paso Electric currently purchases most of its water supply from El Paso Water.

Table 2-10. Steam Electric Power Generation Water Use Projections
(Acre-Feet per Year)

County	2020	2030	2040	2050	2060	2070
Brewster	0	0	0	0	0	0
Culberson	0	0	0	0	0	0
El Paso	10,545	10,545	10,545	10,545	10,545	10,545
Hudspeth	0	0	0	0	0	0
Jeff Davis	0	0	0	0	0	0
Presidio	0	0	0	0	0	0
Terrell	0	0	0	0	0	0

2.2.6 Livestock

Texas is the nation's leading livestock producer, accounting for approximately 11 percent of the total United States production. Although livestock production is an important component of the Texas economy, the industry consumes a relatively small amount of water.

Livestock water demand projections are a combination of an average of the 2010-2014 water use survey information provided by the TWDB, which is based on livestock inventory data from the National Agricultural Statistical Service (NASS) and the Texas Department of Agriculture, and per head water use consumptions by animal class. County-level water use estimates are calculated by applying a water use coefficient for each livestock category to county level inventory estimates. The rate of change for projections from the 2016 Regional Water Plans was then applied to the new base. Many counties chose to hold the base constant throughout the planning horizon. Table 2-11presents livestock category and per head daily water use information.

Table 2-11. Estimated per Head Daily Water Use (in gallons)

TWDB	NASS Data Type	Per Head Daily Water Use
Cattle	Milk	75
	Fed & Other	15
Poultry	Hens	86* (per 1,000 head)
	Broilers	77* (per 1,000 head)
Horses	Horses, Ponies, & Burros	12
Hogs	Hogs	11
Sheep	Sheep	2
Goats	Milk, Meat, Angora	0.5

Source: University of Georgia - College of Agricultural and Environmental Sciences, 2009

For water-supply planning purposes in the Far West Texas Plan, livestock water use is held constant throughout the 50-year planning period. However, reality dictates that during prolonged drought periods, when poor range conditions exist and/or during unfriendly market conditions, livestock herds are generally reduced thus resulting in significantly less water demand. Table 2-12 presents the projected livestock water use for the Region. It is also important to point out that water consumed by wildlife is not a component of these livestock estimates and remains an unaccounted supply volume as described in Section 2.3 Environmental and Recreational Water Needs.

Table 2-12. Livestock Water Use Projections (Acre-Feet per Year)

County	2020	2030	2040	2050	2060	2070
Brewster	347	347	347	347	347	347
Culberson	270	270	270	270	270	270
El Paso	171	171	171	171	171	171

Table 2-13. (continued) Livestock Water Use Projections
(Acre-Feet per Year)

County	2020	2030	2040	2050	2060	2070
Hudspeth	437	437	437	437	437	437
Jeff Davis	397	397	397	397	397	397
Presidio	328	328	328	328	328	328
Terrell	151	151	151	151	151	151

2.2.7 Mining

Although the Texas mineral industry is foremost in the production of crude petroleum and natural gas in the United States, it also produces a wide variety of important nonfuel minerals. In all instances, water is required in the mining of these minerals either for processing, leaching to extract certain ores, controlling dust at the plant site, or for reclamation.

Mining water demand projections were developed by combining annual reported water use data (2010-2014), including reuse and additional oil and gas estimates provided by the TWDB using the FracFocus database. Oil and gas water use estimates are then broken down by water source based on a TWDB-contracted study with the University of Texas Bureau of Economic Geology (BEG) as summarized in Table 2-14 below. The BEG study estimated current mining water use and projected that use across the planning horizon using data collected from trade, organizations, government agencies, and other industry representatives. County-level projections are compiled as the sum of individual projections for four sub-sector mining categories: oil and gas, aggregates, coal and lignite, and other.

Table 2-14. Estimated Percentages of Reuse and Brackish Water Use in Hydraulic Fracturing

Play	Fresh Water	Reuse / Recycle	Brackish
Permian Far West	20%	0%	80%
Permian Midland	68%	2%	30%
Anadarko Basin	50%	20%	30%
Barnett Shale	92%	5%	3%
Eagle Ford Shale	80%	0%	20%
East Texas Basin	95%	5%	0%

Source: University of Texas Bureau of Economics Geology, 2012

A portion of the water used in the non-oil and gas mining industry in Far West Texas (Table 2-14) is related to its use in the quarrying of gravel and road base materials. However, the largest single water use occurs in Culberson County where it is employed in the mining of talc mineral aggregates. New to the FWTRWP is a mining water demand in Jeff Davis County. Due to recent oil and gas activity, approximately 153 acre-feet per year is projected to be exported from Jeff Davis County to meet this new mining demand.

Table 2-15. Mining Water Use Projections
(Acre-Feet per Year)

County	2020	2030	2040	2050	2060	2070
Brewster	0	0	0	0	0	0
Culberson	2,119	2,853	3,006	2,723	2,456	2,253
El Paso	4,008	4,626	5,262	5,948	6,693	7,539
Hudspeth	479	451	468	483	492	502
Jeff Davis	153	153	153	153	153	153
Presidio	403	0	0	0	0	0
Terrell	673	776	740	606	483	385

In recent years, increased oil and gas exploration activity has occurred in the Region, especially in Culberson County where in September 2016 the Apache Corporation announced the discovery of a new oil and natural gas resource play in the southwest corner of the Permian Basin called the Alpine High. The geographic outline of the play extends over 60 miles and is primarily in the southern half of Reeves County, but also falls within the boundaries of Culberson and Jeff Davis counties. The acreage is estimated to hold approximately 75 trillion cubic feet of mostly wet gas and 3 billion barrels of oil in the Barnett and Woodford regions of the field. In addition, significant oil is potentially in the shallower Pennsylvanian, Bone Springs and Wolfcamp formations. The company has identified 2,000 to 3,000 drilling locations and as of September 2017 has released the results of 20 evaluation wells regarding the delineation of the extent of the resource. Nine of those wells are currently in production.

Table 2-16 presents the total volume of water used as a carrier fluid for hydraulic fracturing in Culberson County from 2012-2017.

Table 2-16. Total Volume of Water Used for Hydraulic Fracturing in Culberson County
(Acre-Feet per Year)

Year	Total Base Water Volume
2012	34
2013	574
2014	1,651
2015	2,221
2016	1,715
2017	1,377

Source: FracFocus

The volume of water that is anticipated for this project is presently speculative, and therefore the Far West Texas Planning Group chooses not to include the estimates in the Table 2-14 mining projections until such time that their anticipated use becomes more established. Until then, the Planning Group intends to closely monitor this potentially significant water use.

2.3 ENVIRONMENTAL AND RECREATIONAL WATER NEEDS

Environmental and recreational water use in Far West Texas is not quantified but is recognized as being an important consideration as it relates to the natural community in which the residents of this Region share and appreciate. In Chapter 1, environmental and eco-recreational resources are identified and described. In the following paragraphs, the water resources needed to maintain these functions is discussed. Water-supply sources that serve environmental needs, along with identified major springs, are characterized in Chapter 3, and potential water-supply strategy impacts on the environment are considered in Chapter 5. Chapter 8 contains a discussion and recommendations pertaining to "Ecologically Unique River and Stream Segments."

In terms of combined area, Far West Texas contains most of the federal public land in Texas, and over half the land in the entire Texas State Park system. The presence of these protected public lands contributes greatly to the quality of life for area residents in a way that is not easily described in gallons, acre-feet or dollars and cents. It has been amply demonstrated that to attract 21st century enterprise that pays top salaries for skilled workers, quality of life is a critical issue. The spectacular natural and cultural heritage of the Region not only attracts many hundreds of thousands of temporary visitors per year to Far West Texas (more than 650,000 per year just to Guadalupe Mountains and Big Bend National Parks), it also helps to attract new residents and businesses to the Region. Providing sufficient water for recreation and habitat in Far West Texas is critical to long-term economic health.

All living organisms require water. The amount and quality of water required to maintain a viable population, whether it be plant or animal, is highly variable. While some individuals can migrate long distances in search of water (birds, larger mammals, etc.), others are stationary (plants, fishes, etc.) and must rely on existing supplies. In both cases, endemic wildlife to this desert region of Texas has adapted to the harsh climatic conditions.

Because most available water-supply sources in Far West Texas are relatively small in areal extent and are generally separated by great distances, wildlife dependent on isolated sources exist at the mercy of that water supply. The loss of the supply source, even for a short time, may result in the loss or degradation of the resident species.

Quantifying minimum flows at upland water sources that support wildlife and game through the year is difficult in terms of gallons and acre-feet; however, it is an observable fact that wildlife populations flux wildly over the years due to relative abundance or scarcity of rainfall and related spring productivity. It has also been observed that even major springs that historically have never run dry can disappear when local aquifers are pumped beyond sustainable levels. Even minor aquifer depletion can have a profound effect on wildlife habitat and recreational opportunities in affected local areas.

Quantifying environmental and recreational water needs in some cases has been achieved. For the Rio Grande below Presidio, measured at the IBWC gage below Alamito Creek, a flow of 250 cubic feet per second is sufficient to support minimum needs. When flows fall below this point for any length of time, recreational, agricultural, and habitat values are seriously degraded.

Recreation includes those activities that involve human interaction with the outdoors environment. Many of these activities are directly dependent on water resources such as fishing, swimming, and boating; while a healthy environment enhances many others, such as hiking and bird watching. Thus, it is recognized that the maintenance of the regional environmental community's water supply needs serves to enhance the lives of citizens of Far West Texas as well as the thousands of annual visitors to this Region.

In terms of the regional planning process, discussion of environmental and recreational water needs has been largely considered a rural issue, and generally overlooked because of the perceived priority of other issues. However, every regional resident uses environmental and recreational water, be it for personal lawn and garden, a golf course, a swimming pool, or for canoeing the Rio Grande, hunting deer, or watching birds. In urban areas and small towns, environmental and recreational needs can constitute a third or more of total use during hot months. The FWTWPG recognizes the importance of supplying adequate environmental and recreational water fairly to all users and supports the goal of better quantifying those needs in future planning cycle.

Natural and environmental resources are often overlooked when considering the consequences of prolonged drought conditions. As water supplies diminish during drought periods, the balance between both human and environmental water requirements becomes increasingly competitive. A goal of the *2021 Far West Texas Water Plan* is to provide for the health, safety, and welfare of the human community, with as little detrimental effect to the environment as possible. To accomplish this goal, the evaluation of strategies to meet future water needs includes a distinct consideration of the impact that each implemented strategy might have on the environment.

In Chapter 5, each water management strategy contains an environmental impact assessment. A review of this chapter reveals that while some strategies may contain variable levels of negative impact, other strategies may likely have a positive effect. Negative environmental impacts are generally associated with the lowering of aquifer water levels due to increased groundwater withdrawals and its potential to cause springs to cease flowing. Also, of concern is that lowered water levels could deplete supplies in shallow livestock wells that are often the only available source of water for some wildlife. The positive environmental aspect of the strategies is that during severe drought conditions when normal wildlife water supplies may naturally diminish, new supply sources might be developed such that wildlife could benefit.

CHAPTER 3

REGIONAL WATER SUPPLY SOURCES

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3 REGIONAL WATER SUPPLY SOURCES

Whether it flows in rivers or percolates through underground rock formations, water sustains life and thus is our most important natural resource. In the Chihuahuan Desert environment of Far West Texas, water supply availability takes on a more significant meaning than elsewhere in the State. With evaporation far exceeding rainfall, planning for the most efficient management of limited water supplies is essential.

Chapter 3 explores the current and future availability of all water supply resources in the Region including surface water, groundwater, and reuse; all of which is contained within the Rio Grande River Basin. The water demand and supply availability analysis developed in Chapters 2 and 3, respectively, form the basis for identifying in Chapter 4 the areas within Far West Texas that potentially could experience supply shortages in future years. Water supply availability from each recognized source is estimated during *drought-of-record* conditions, which allows each entity and water-use category to evaluate conditions when their supply source is at its most critical availability level.

- Except for controlled flows in the Rio Grande, very little surface water can be considered as a reliable source of supply in Far West Texas, especially in drought-of-record conditions. In this chapter, two primary surface water sources are considered, the Rio Grande and the Pecos River. Other ephemeral creeks and springs (cienegas) are recognized as important livestock supply, wildlife habitat, and recreational resources. The availability of water in the Rio Grande and Pecos River (Run-of-River) to meet existing water rights, including municipal water rights, is determined by the TCEQ Rio Grande Water Availability Model (WAM)–Run 3, except for supplies from the Rio Grande Project. All surface water rights are listed in Appendix 3A.
- The availability of groundwater is based on TWDB provided Modeled Available Groundwater (MAG) as developed through the Groundwater Management Area process. For aquifers that MAG volumes have not been assigned, groundwater availability is calculated separately.
- Direct reuse refers to wastewater that is reused without first being discharged into a stream or other watercourse. Direct reuse of water is calculated for El Paso Water based on anticipated build-out of their "purple pipe" project and advanced purified water treatment projects. Indirect reuse refers to wastewater that is first discharged to a stream or watercourse before being diverted for use. The indirect reuse supply is used during the irrigation season.
- No groundwater availability requirements or limitations as might have been promulgated by the El Paso County Commissioner's Court are associated with the El Paso County Priority Groundwater Management Area. El Paso Water continues to assume the role as the designated "Regional Water Supply Planner" (see Chapter 1, Section 1.1.6).
- Water supplies based upon contracts are assumed to be renewed if they expire during the planning horizon.

Water supplies available to meet projected demands are reported in Tables 3-1, 3-2 and 3-3. Table 3-1 indicates the maximum amount of water supply that can be obtained from each unique supply source. Table 3-2 lists water supplies that are available to municipal utilities and other water-user categories, based on current infrastructure, legal limitations, and the physical availability of water from each source determine this availability. Table 3-3 lists supplies available to major/wholesale water providers. The amounts listed for municipal utilities and the "county other" category (representing small communities and rural households) are based on TCEQ estimates of infrastructure capacities.

Table 3-1. Water Supply Source Availability (Rio Grande River Basin)
(Acre Feet per Year)

Groundwater	County	Salinity	2020	2030	2040	2050	2060	2070
Bone Spring-Victorio Peak Aquifer	Hudspeth	Fresh/Brackish	101,400	101,400	101,400	101,400	101,400	101,400
Capitan Reef Complex Aquifer	Brewster	Fresh/Brackish	583	583	583	583	583	583
Capitan Reef Complex Aquifer	Culberson	Fresh/Brackish	7,580	7,580	7,580	7,580	7,580	7,580
Capitan Reef Complex Aquifer | Non-Relevant	Hudspeth	Fresh/Brackish	8,695	8,695	8,695	8,695	8,695	8,695
Capitan Reef Complex Aquifer | Non-Relevant	Jeff Davis	Fresh	0	0	0	0	0	0
Edwards-Trinity (Plateau) Aquifer	Brewster	Fresh/Brackish	1,394	1,394	1,394	1,394	1,394	1,394
Edwards-Trinity (Plateau) Aquifer | Non-Relevant	Culberson	Fresh	399	399	399	399	399	399
Edwards-Trinity (Plateau), Pecos Valley, Trinity Aquifer	Terrell	Fresh	1,420	1,420	1,420	1,420	1,420	1,420
Hueco-Mesilla Bolson Aquifer	El Paso	Fresh/Brackish	435,000	435,000	435,000	435,000	435,000	435,000
Hueco-Mesilla Bolson Aquifer	Hudspeth	Fresh/Brackish	45,000	45,000	45,000	45,000	45,000	45,000
Igneous Aquifer	Brewster	Fresh	2,586	2,586	2,585	2,583	2,583	2,582
Igneous Aquifer	Culberson	Fresh	99	99	99	99	99	99
Igneous Aquifer	Jeff Davis	Fresh	4,584	4,584	4,584	4,584	4,584	4,584
Igneous Aquifer	Presidio	Fresh	4,064	4,064	4,064	4,063	4,063	4,063
Marathon Aquifer	Brewster	Fresh	7,327	7,327	7,327	7,327	7,327	7,327
Other Aquifer | Brewster Cretaceous	Brewster	Fresh	1,896	1,896	1,896	1,896	1,896	1,896
Other Aquifer | Rio Grande Alluvium	El Paso	Brackish	57,922	57,922	57,922	57,922	57,922	57,922
Other Aquifer | Rio Grande Alluvium	Hudspeth	Brackish	52,478	52,478	52,478	52,478	52,478	52,478
Other Aquifer | Diablo Plateau	Hudspeth	Fresh	26,400	26,400	26,400	26,400	26,400	26,400
Pecos Valley, Edwards-Trinity (Plateau) Aquifer | Non-Relevant	Jeff Davis	Fresh	374	374	374	374	374	374
Rustler Aquifer | Non-Relevant	Brewster	Brackish/Saline	0	0	0	0	0	0
Rustler Aquifer | Non-Relevant	Culberson	Brackish/Saline	53	53	53	53	53	53
Rustler Aquifer | Non-Relevant	Jeff Davis	Fresh	0	0	0	0	0	0

Table 3-1. (Continued) Water Supply Source Availability (Rio Grande River Basin)
(Acre Feet per Year)

Groundwater	County	Salinity	2020	2030	2040	2050	2060	2070
West Texas Bolsons Aquifer | Upper Salt Basin	Culberson	Brackish	16,851	16,851	16,851	16,851	16,851	16,851
West Texas Bolsons Aquifer | Wild Horse, Michigan and Lobo	Culberson	Fresh/Brackish	35,749	35,678	35,601	35,550	35,476	35,409
West Texas Bolsons Aquifer | Upper Salt Basin | Non-Relevant	Hudspeth	Brackish	429	429	429	429	429	429
West Texas Bolsons | Red Light Draw, Eagle Flat, Green River Valley	Hudspeth	Fresh/Brackish	4,582	4,582	4,582	4,582	4,582	4,582
West Texas Bolsons Aquifer | Green River Valley and Ryan Flat	Jeff Davis	Fresh	6,137	6,137	6,071	6,042	6,009	5,974
West Texas Bolsons | Green River Valley, Presidio-Redford	Presidio	Fresh/Brackish	7,743	7,743	7,743	7,743	7,743	7,743
West Texas Bolsons Aquifer | Ryan Flat	Presidio	Fresh	9,112	8,982	8,834	8,710	8,571	8,436
Groundwater Total Source Availability			**839,857**	**839,656**	**839,364**	**839,157**	**838,911**	**838,673**
Reuse	**County**	**Salinity**	**2020**	**2030**	**2040**	**2050**	**2060**	**2070**
Direct Reuse	El Paso	Fresh	19,748	21,025	22,150	23,374	24,530	25,836
Direct Reuse	Brewster	Fresh	193	193	193	193	193	193
Indirect Reuse	El Paso	Fresh	34,169	34,169	34,169	34,169	34,169	34,169
Indirect Reuse	Hudspeth	Fresh	334	334	334	334	334	334
Reuse Total Source Availability			**54,444**	**55,721**	**56,846**	**58,070**	**59,226**	**60,532**
Surface Water	**County**	**Salinity**	**2020**	**2030**	**2040**	**2050**	**2060**	**2070**
Rio Grande Run-of-River	Brewster	Fresh	7,774	7,774	7,774	7,774	7,774	7,774
Rio Grande Run-of-River	El Paso	Fresh	46,605	46,605	46,605	46,605	46,605	46,605
Rio Grande Run-of-River	Hudspeth	Fresh	725	725	725	725	725	725
Rio Grande Run-of-River	Presidio	Fresh	10,218	10,218	10,218	10,218	10,218	10,218
Rio Grande Run-of-River	Terrell	Fresh	441	441	441	441	441	441
Surface Water Total Source Availability			**65,763**	**65,763**	**65,763**	**65,763**	**65,763**	**65,763**
Region E Total Source Availability			**960,064**	**961,140**	**961,973**	**962,990**	**963,900**	**964,968**

Note: Largest amount of water that can be withdrawn from a given source without violating the most restrictive physical, regulatory, or policy conditions limiting withdrawals, under drought-of-record conditions. All sources are within the Rio Grande Basin.

Table 3-2. Water User Group Existing Water Supply (Rio Grande River Basin)
(Acre Feet per Year)

Brewster County		**2020**	**2030**	**2040**	**2050**	**2060**	**2070**
Alpine	Igneous | Brewster County	1,238	1,238	1,238	1,238	1,238	1,238
Alpine	Igneous | Jeff Davis County	1,234	1,234	1,234	1,234	1,234	1,234
Alpine	Direct Reuse	84	84	84	84	84	84
Lajitas Municipal Services	Other Aquifer | Brewster Cretaceous	331	331	331	331	331	331
Marathon WSSS	Marathon	242	242	242	242	242	242
County-Other	Edwards-Trinity (Plateau)	23	23	23	23	23	23
County-Other	Igneous	446	446	446	446	446	446
County-Other	Other Aquifer | Brewster Cretaceous	217	217	217	217	217	217
Livestock	Capitan Reef Complex	30	30	30	30	30	30
Livestock	Edwards-Trinity (Plateau)	97	97	97	97	97	97
Livestock	Igneous	112	112	112	112	112	112
Livestock	Marathon	15	15	15	15	15	15
Livestock	Other Aquifer | Brewster Cretaceous	112	112	112	112	112	112
Irrigation	Igneous	291	291	291	291	291	291
Irrigation	Marathon	309	309	309	309	309	309
Irrigation	Other Aquifer | Brewster Cretaceous	1,236	1,236	1,236	1,236	1,236	1,236
Irrigation	Rio Grande Run-Of-River	1,551	1,551	1,551	1,551	1,551	1,551
Brewster County Total Existing Supply		**7,568**	**7,565**	**7,568**	**7,568**	**7,568**	**7,568**
Culberson County		**2020**	**2030**	**2040**	**2050**	**2060**	**2070**
Van Horn	West Texas Bolsons (Wild Horse, Michigan, Lobo)	1,016	1,016	1,016	1,016	1,016	1,016
County-Other	Edwards-Trinity (Plateau)	3	3	3	3	3	3
County-Other	Rustler	2	2	2	2	2	2
County-Other	West Texas Bolsons (Wild Horse, Michigan, Lobo, Upper Salt Basin)	152	152	152	152	152	152
Manufacturing	West Texas Bolsons (Wild Horse, Michigan, Lobo)	6	6	6	6	6	6
Mining	Capitan Reef Complex	2,000	2,000	2,000	2,000	2,000	2,000
Mining	Rustler	0	0	0	0	0	0
Mining	West Texas Bolsons (Wild Horse, Michigan, Lobo, Upper Salt Basin)	2,045	2,045	2,045	2,045	2,045	2,045
Livestock	Capitan Reef Complex	55	55	55	55	55	55
Livestock	Edwards-Trinity (Plateau)	20	20	20	20	20	20
Livestock	Igneous	15	15	15	15	15	15
Livestock	Rustler	31	31	31	31	31	31
Livestock	West Texas Bolsons (Wild Horse, Michigan, Lobo, Upper Salt Basin)	164	164	164	164	164	164
Irrigation	Capitan Reef Complex	5,525	5,525	0	0	0	0
Irrigation	West Texas Bolsons (Wild Horse, Michigan, Lobo)	32,005	32,005	32,005	32,005	32,005	32,005
Culberson County Total Existing Supply		**43,039**	**43,039**	**37,514**	**37,514**	**37,514**	**37,514**
El Paso County		**2020**	**2030**	**2040**	**2050**	**2060**	**2070**
Anthony	Hueco-Mesilla Bolson	1,532	1,532	1,532	1,532	1,532	1,532
East Biggs Water System	Hueco-Mesilla Bolson	1,242	1,242	1,242	1,242	1,242	1,242
East Montana Water System	Hueco-Mesilla Bolson	1,241	1,241	1,241	1,241	1,241	1,241
El Paso County Tornillo WID	Hueco-Mesilla Bolson	807	807	807	807	807	807

Table 3-2. (continued) Water User Group Existing Water Supply (Rio Grande River Basin)
(Acre Feet per Year)

El Paso County		**2020**	**2030**	**2040**	**2050**	**2060**	**2070**
El Paso County WCID 4	Hueco-Mesilla Bolson	1,855	1,855	1,855	1,855	1,855	1,855
El Paso Water	Direct Reuse	6,000	6,000	6,000	6,000	6,000	6,000
El Paso Water	Hueco-Mesilla Bolson	115,000	115,000	115,000	115,000	115,000	115,000
El Paso Water	Rio Grande Run-Of-River	10,000	10,000	10,000	10,000	10,000	10,000
Federal Correctional Institution La Tuna	Hueco-Mesilla Bolson	2,016	2,016	2,016	2,016	2,016	2,016
Fort Bliss Water Services	Hueco-Mesilla Bolson	7,158	7,158	7,158	7,158	7,158	7,158
Haciendas Del Norte WID	Hueco-Mesilla Bolson	306	306	306	306	306	306
Horizon Regional MUD	Hueco-Mesilla Bolson	3,649	3,649	3,649	3,649	3,649	3,649
Horizon Regional MUD	Other Aquifer | Rio Grande Alluvium	1,578	1,578	1,578	1,578	1,578	1,578
Lower Valley WD	Hueco-Mesilla Bolson	4,356	4,356	4,356	4,356	4,356	4,356
Paseo Del Este MUD 1	Hueco-Mesilla Bolson	1,629	1,629	1,629	1,629	1,629	1,629
County-Other | Vinton Hills Estates	Hueco-Mesilla Bolson	120	120	120	120	120	120
County-Other | Vinton Hills Subdivision	Hueco-Mesilla Bolson	280	280	280	280	280	280
County-Other	Hueco-Mesilla Bolson	6,278	6,278	6,278	6,278	6,278	6,278
Manufacturing	Hueco-Mesilla Bolson	7,297	7,297	7,297	7,297	7,297	7,297
Mining	Hueco-Mesilla Bolson	810	810	810	810	810	810
Mining	Other Aquifer | Rio Grande Alluvium	1,347	1,347	1,347	1,347	1,347	1,347
Steam Electric Power	Hueco-Mesilla Bolson	3,285	3,285	3,285	3,285	3,285	3,285
Livestock	Hueco-Mesilla Bolson	205	205	205	205	205	205
Livestock	Other Aquifer | Rio Grande Alluvium	33	33	33	33	33	33
Irrigation	Hueco-Mesilla Bolson	7,392	7,392	7,392	7,392	7,392	7,392
Irrigation	Other Aquifer | Rio Grande Alluvium	30,000	30,000	30,000	30,000	30,000	30,000
Irrigation	Rio Grande Indirect Reuse	34,169	34,169	34,169	34,169	34,169	34,169
Irrigation	Rio Grande Run-Of-River	31,605	31,605	31,605	31,605	31,605	31,605
El Paso County Total Existing Supply		**281,190**	**281,190**	**281,190**	**281,190**	**281,190**	**281,190**
Hudspeth County		**2020**	**2030**	**2040**	**2050**	**2060**	**2070**
Esperanza Water Service	Hueco-Mesilla Bolson	484	484	484	484	484	484
Hudspeth County WCID 1: Sierra Blanca	West Texas Bolsons (Wild Horse, Michigan, Lobo)	532	532	532	532	532	532
County-Other | Dell City	Bone Spring-Victorio Peak	63	63	63	63	63	63
County-Other | Fort Hancock WCID	Other Aquifer |Rio Grande Alluvium	270	270	270	270	270	270
County-Other	Hueco-Mesilla Bolson	23	23	23	23	23	23
Mining	Hueco-Mesilla Bolson	52	52	52	52	52	52
Mining	Other Aquifer |Rio Grande Alluvium	21	21	21	21	21	21

Table 3-2. (continued) Water User Group Existing Water Supply (Rio Grande River Basin)
(Acre Feet per Year)

Hudspeth County		**2020**	**2030**	**2040**	**2050**	**2060**	**2070**
Mining	West Texas Bolsons (Upper Salt Basin)	210	210	210	210	210	210
Livestock	Bone Spring-Victorio Peak	84	84	84	84	84	84
Livestock	Capitan Reef Complex	7	7	7	7	7	7
Livestock	Hueco-Mesilla Bolson	11	11	11	11	11	11
Livestock	Other Aquifer | Diablo Plateau	281	281	281	281	281	281
Livestock	West Texas Bolsons (Red Light Draw, Eagle Flat, Green River Valley)	77	77	77	77	77	77
Irrigation	Bone Spring-Victorio Peak	68,495	68,495	68,495	68,495	68,495	68,495
Irrigation	Capitan Reef Complex	4,213	4,213	4,213	4,213	4,213	4,213
Irrigation	Other Aquifer | Rio Grande Alluvium	52,187	52,187	52,187	52,187	52,187	52,187
Irrigation	Rio Grande Indirect Reuse	334	334	334	334	334	334
Irrigation	Rio Grande Run-Of-River	725	725	725	725	725	725
Hudspeth County Total Existing Supply		**128,069**	**128,069**	**128,069**	**128,069**	**128,069**	**128,069**
Jeff Davis County		**2020**	**2030**	**2040**	**2050**	**2060**	**2070**
Fort Davis WSC	Igneous	468	468	468	468	468	468
County-Other | City of Valentine	West Texas Bolsons (Ryan Flat)	29	29	29	29	29	29
County-Other	Igneous	315	315	315	315	315	315
County-Other	Pecos Valley | Edwards-Trinity (Plateau)	0	0	0	0	0	0
Mining	Igneous	153	153	153	153	153	153
Livestock	Igneous	299	299	299	299	299	299
Livestock	Pecos Valley | Edwards-Trinity (Plateau)	108	108	108	108	108	108
Livestock	West Texas Bolsons (Ryan Flat)	63	63	63	63	63	63
Irrigation	Igneous	735	735	735	735	735	735
Irrigation	Pecos Valley | Edwards-Trinity (Plateau)	70	70	70	70	70	70
Irrigation	West Texas Bolsons (Green River Valley and Ryan Flat)	561	561	561	561	561	561
Jeff Davis County Total Existing Supply		**2,801**	**2,801**	**2,801**	**2,801**	**2,801**	**2,801**
Presidio County		**2020**	**2030**	**2040**	**2050**	**2060**	**2070**
Marfa	Igneous Aquifer	2,097	2,097	2,097	2,097	2,097	2,097
Presidio	West Texas Bolsons (Presidio Redford)	3,766	3,766	3,766	3,766	3,766	3,766
County-Other	Igneous	289	289	289	289	289	289
County-Other	West Texas Bolsons (Presidio Redford)	193	193	193	193	193	193
Mining	West Texas Bolsons (Presidio Redford)	403	403	403	403	403	403
Livestock	Igneous	224	224	224	224	224	224
Livestock	West Texas Bolsons (Presidio Redford, Ryan Flat)	142	142	142	142	142	142
Irrigation	Igneous	605	605	605	605	605	605
Irrigation	Rio Grande Run-Of-River	6,140	6,140	6,140	6,140	6,140	6,140
Irrigation	West Texas Bolsons (Presidio Redford, Ryan Flat)	2,256	2,256	2,256	2,256	2,256	2,256
Presidio County Total Existing Supply		**16,115**	**16,115**	**16,115**	**16,115**	**16,115**	**16,115**

Table 3-2. (continued) Water User Group Existing Water Supply (Rio Grande River Basin)
(Acre Feet per Year)

Terrell County		**2020**	**2030**	**2040**	**2050**	**2060**	**2070**
Terrell County WCID 1	Edwards-Trinity (Plateau) | Pecos Valley | Trinity	476	476	476	476	476	476
County-Other	Edwards-Trinity (Plateau) | Pecos Valley | Trinity	75	75	75	75	75	75
Mining	Edwards-Trinity (Plateau) | Pecos Valley | Trinity	190	190	190	190	190	190
Livestock	Edwards-Trinity (Plateau) | Pecos Valley | Trinity	206	206	206	206	206	206
Irrigation	Edwards-Trinity (Plateau) | Pecos Valley | Trinity	473	473	473	473	473	473
Irrigation	Rio Grande Run-Of-River	441	441	441	441	441	441
Terrell County Total Existing Supply		**1,861**	**1,861**	**1,861**	**1,861**	**1,861**	**1,861**
Region E Existing Water Supply		**480,643**	**480,643**	**475,118**	**475,118**	**475,118**	**475,118**

Note: Water Supply capacity based on current infrastructure, existing contracts, and source supply availability under drought-of-record conditions.
All WUGs and supplies are within the Rio Grande Basin

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Table 3-3. Far West Texas Major Water Provider Supplies (Rio Grande River Basin)
(Acre-Feet per Year)

Major Water Provider	**Source Supply**	**Water Demand (Acre-Feet/Year)**					
		2020	**2030**	**2040**	**2050**	**2060**	**2070**
El Paso County WID#1	Rio Grande Indirect Reuse	34,169	34,169	34,169	34,169	34,169	34,169
	Rio Grande Alluvium Aquifer	30,000	30,000	30,000	30,000	30,000	30,000
	Rio Grande Run-Of-River	31,605	31,605	31,605	31,605	31,605	31,605
	Hueco-Mesilla Bolson Aquifer	7,392	7,392	7,392	7,392	7,392	7,392
	Total Supply	**103,166**	**103,166**	**103,166**	**103,166**	**103,166**	**103,166**
El Paso Water	Direct Reuse	6,000	6,000	6,000	6,000	6,000	6,000
	Hueco-Mesilla Bolson Aquifer	115,000	115,000	115,000	115,000	115,000	115,000
	Rio Grande Run-Of-River	10,000	10,000	10,000	10,000	10,000	10,000
	Total Supply	**131,000**	**131,000**	**131,000**	**131,000**	**131,000**	**131,000**
Lower Valley Water District	Hueco-Mesilla Bolson Aquifer	4,356	4,356	4,356	4,356	4,356	4,356
	Total Supply	**4,356**	**4,356**	**4,356**	**4,356**	**4,356**	**4,356**
Horizon Regional MUD	Hueco-Mesilla Bolson Aquifer	3,649	3,649	3,649	3,649	3,649	3,649
	Rio Grande Alluvium Aquifer	1,578	1,578	1,578	1,578	1,578	1,578
	Total Supply	**5,227**	**5,227**	**5,227**	**5,227**	**5,227**	**5,227**

3.1 SURFACE WATER

Surface water supplies in the Far West Texas Region (Region E) are obtained from the Rio Grande River and Pecos River, a tributary of the Rio Grande. During drought-of-record conditions, there is very little reliable surface water in Region E, except for controlled releases in the Rio Grande.

In accordance with regional planning rules and guidelines, the Far West Texas Region used the Full Authorization Run (Run 3) of the TCEQ-approved water availability model (WAM) of the Rio Grande Basin (Version 2/1/2018; WROP Version 4/5/2016; Hydrologic Period 1940 – 2000) for determining surface water availability in the region. The exception is water from the Rio Grande Project, which is located in New Mexico and is discussed below. The WAM is a computer model of the Rio Grande watershed that evaluates surface water availability based on Texas water rights. It is maintained by the TCEQ for the purpose of reviewing and granting new surface water right permits and required by TWDB to evaluate surface water availability for regional water planning purposes. The amount of water that can actually be diverted by a water right is referred to as the water availability and may be less than the permitted amount.

The prior appropriation doctrine governs surface water law in Texas and can be summarized as "first in time is first in right." Each water right in the WAM is assigned a priority date that determines the order in which water is allocated among water rights in the Rio Grande Basin. In times when there are shortages, water rights with older priority dates are given preference when allocating water. The oldest water rights in the Rio Grande WAM date to the 1700s and correspond to the date when water was first put to beneficial use by people besides the native Pueblo Indians.

In contrast to other regions, the available surface water supplies in Far West Texas consist almost entirely of run-of-river supplies with the exception of small impoundments for domestic and livestock purposes and water provided through the Rio Grande Project. A run-of-river right is authorized to divert from a stream but does not have authorization for storage. According to Texas law, water users with small impoundments up to 200 acre-feet for domestic and livestock purposes do not require a water right. The Bureau of Reclamation's Rio Grande Project includes releases from Elephant Butte and Caballo Reservoirs as well as run-of-river flows entering Texas from New Mexico.

As intended by Senate Bill 1, the assessment of surface water availability in the Far West Texas Region was conducted to reflect water supplies that are currently available for use. The available supply from a run-of-river water right is calculated as the minimum annual diversion during the period-of-record (1940-2000) as simulated in the WAM. The assessment includes updates to new water right permits, current operating policies and contractual agreements. The following changes were made to the WAM to more accurately reflect the current conditions and operations of the region and are consistent with the assumptions used in previous Far West Texas water plans, except where noted.

- The supply from the Rio Grande Project is not based on the WAM but on the lowest annual historical allotment delivered to the entities served by the Project, which occurred in 2013. The period-of-record for the WAM only extends to year 2000 and so does not cover the most recent drought. The supply from the Project does not include return flows, which were evaluated separately. Entities served by the Rio Grande Project include El Paso Water, El Paso County Water Improvement District #1, and irrigators in Hudspeth County.
- The demand pattern for irrigation rights above Fort Quitman was modified so that diversions only occur from March through October to be consistent with actual operation of the Rio Grande Project.
- The TCEQ Rio Grande WAM was updated to reflect adjudicated water rights above Fort Quitman. Cancelled or abandoned claims and permits were removed from the WAM. No new water rights were added to the WAM.

- Modeling proposed by Region F in the Balmorhea area of the Pecos Basin was incorporated into the modified WAM. These changes are related to San Solomon Springs and Giffin Springs flows, which in the unmodified TCEQ WAM were being passed downstream instead of being used by the water rights dependent on those springs. In reality, these flows would be lost before they reached the Pecos River, resulting in what is termed a futile call. This change had not been included in previous water plans for the Far West Texas Region.

These modifications were approved by the Executive Administrator (EA) of the Texas Water Development Board in a letter to the Chairman of the Far West Texas Water Planning Group, dated April 18, 2018. The results of the modified WAM combined with the assumptions for availability from the Rio Grande Project indicate that the surface water supply in Far West Texas totals 65,763 acre-feet per year throughout the planning period (2020 to 2070) (Table 3-1). Of that, the Rio Grande Project supplies 42,333 acre-feet per year (i.e. the minimum allotment in 2013) to water users in El Paso and Hudspeth Counties. The apportionment of Rio Grande Run-of-River is explained below in Table 3-4.

Table 3-4. Surface Water Source Availability Methodology

Water Supply Source	County	Annual Availability (Acre-Feet/Year)	Remarks
Rio Grande Run-of-River	Brewster	7,774	WAM3 with no return flows
	El Paso	41,605	U.S. Bureau of Reclamation reported minimum annual diversion of Project water occurred in 2013. Total amount from Rio Grande Project (42,043) was apportioned to irrigators in El Paso County and Hudspeth County based on percentages in WAM. This results in 41,605 for El Paso and 438 for Hudspeth.
	Hudspeth	725	Hudspeth County irrigators get 438 from Rio Grande Project water based on 2013 availability.
			Hudspeth County irrigators also get 287 (WAM) below Fort Quitman that are not included in the Rio Grande Project totals.
	Presidio	10,218	WAM3
	Terrell	441	WAM3; Lower Rio Grande = 152 & Pecos River = 289. Total = 441

3.1.1 Rio Grande

Waters of the Rio Grande (Mexico's Rio Bravo) originate in the San Luis Valley, the principal drainage basin of the San Juan Mountains in southwestern Colorado, and in the mountain ranges of northern New Mexico. The river flows southward through New Mexico, and then forms the international boundary between the Mexican States of Chihuahua, Coahuila, Nuevo Leon, Tamaulipas, and the State of Texas. The Rio Grande's total length is approximately 1,896 miles, with approximately 1,248 making the international boundary between Texas and Mexico. Figure 3-1 illustrates the drainage basins of the Rio Grande within the Far West Texas Region.

The water supply available from the Upper Rio Grande is affected by climatic conditions in Colorado and northern New Mexico. Although dams have been built on the River in New Mexico to provide a degree of control, floods and droughts still take their toll in the region. Most of the Rio Grande's flow above Fort Quitman is diverted at the Mesilla Dam in New Mexico to support irrigation in Dona Ana County, New Mexico and at the American Dam in Texas to supply irrigation and municipal demands in Texas. Water is also diverted at the International Dam for delivery through the Acequia Madre to supply irrigation demand in Mexico as stipulated by Treaty. Downstream from El Paso, most of the flow in the River consists of irrigation return flow, and both treated and untreated municipal wastewater discharge from both sides of the border.

The flow from Fort Quitman to Presidio is often intermittent and is commonly referred to as the "Forgotten River". The River becomes a permanent stream again at the junction where the Mexican river, the Rio Conchos, enters the Rio Grande upstream of Presidio. From Presidio downstream through the Big Bend until it reaches the Amistad Reservoir, the Rio Grande often lacks sufficient flow to adequately support minimum recreational, environmental, or agricultural needs; and during dry periods, may fall significantly short of supplying such needs.

Under drought conditions in the upper catchment basin, flows in the Rio Grande are significantly reduced and are allotted by the United States Bureau of Reclamation (USBR) in accordance with a prearranged schedule. Low releases and diversions significantly affect downstream water users who are highly dependent on a steady source of river water. In addition, such low diversions result in a degradation of the River's water and environmental quality.

American Heritage River Initiative – The Rio Grande, from El Paso to Laredo, is one of only 14 rivers in the United States, and the only river in Texas, to receive the American Heritage River designation. Established in 1997, the American Heritage River Initiative recognizes rivers, or segments of rivers, that have played a significant role in the history and culture of the region it traverses. The Initiative gives federal support to voluntary community-led work that benefits riverfront communities. Some of the possible benefits of being designated an American Heritage River are increased opportunities in commerce and trade, recreational improvements along the River, incorporation of wildlife habitats, and cultural stimulation. The American Heritage River Initiative does not conflict with matters of state and local government jurisdiction, such as water rights, land-use planning and water-quality standards. Also, the initiative does not impair the authority of each state to allocate quantities of water within its jurisdiction.

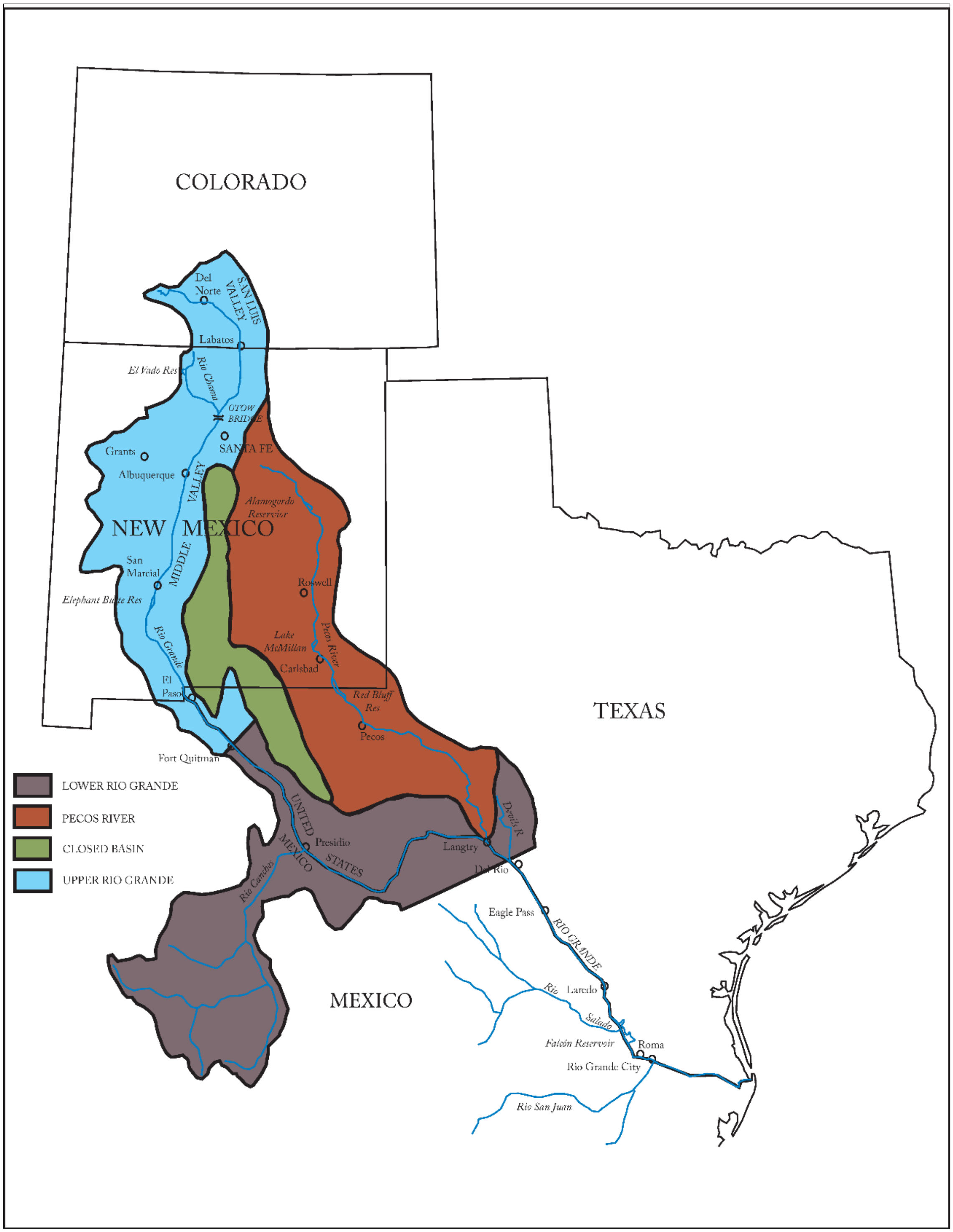

Figure 3-1. Rio Grande Drainage Basins Above Amistad Reservoir
(USGS Professional Paper 372-D)

Rio Grande Wild and Scenic River – In 1978, Congress designated a 196-mile reach of the Rio Grande, from the Coahuila-Chihuahua State line, near Mariscal Canyon, to the Terrell-Val Verde County line, a "Wild and Scenic River". Approximately 69 miles of the designated river stretch is within Big Bend National Park. This segment of the River is recommended by the Far West Texas Water Planning Group (FWTWPG) as an "Ecologically Unique River Segment" and is discussed in further detail in Chapter 8.

3.1.1.1 Rio Grande Treaties and Compact

Water demand related to irrigation use and population growth has impacted the Rio Grande since the 1800s. Water appropriations and shortages have spawned lawsuits, as well as the involvement of the federal government in the management of the River. The following sections describe efforts by state and national governments to address many of the complex management issues associated with the Rio Grande.

1906 International Treaty – Under the 1906 International Treaty, the United States is obligated to deliver 60,000 acre-feet of water annually from the Rio Grande to Mexico, except in case of extraordinary drought or serious accident to the irrigation system in the United States. The 60,000 acre-feet must be delivered, at no cost to Mexico and in accordance with a monthly distribution schedule from February through November, in the bed of the Rio Grande at the headworks of the Acequia Madre (International Dam). The International Boundary and Water Commission (IBWC)/Comisión International de Límites y Aguas (CILA) is the designated binational agency that makes the yearly delivery of international waters to Mexico. The U.S. Bureau of Reclamation (USBR) calculates the allocations in coordination with the IBWC.

Rio Grande Compact – The Rio Grande Compact signed in 1938 is a tri-state agreement, approved by the U.S. Congress and ratified by the states of Colorado, New Mexico and Texas. The Rio Grande Compact Commission, which administers the Compact, is comprised of a Commissioner from each of the states and a nonvoting chairman appointed by the President of the United States. The Compact encompasses the waters of the Rio Grande from the southern Colorado headwaters to above Fort Quitman, Texas and equitably apportions them between the three states. It sets out a schedule of the water-delivery obligation of Colorado at the Colorado/New Mexico state line and the obligation of New Mexico to deliver water to Texas via Rio Grande Project reservoirs at Elephant Butte and Caballo. Releases from the reservoirs are measured downstream of Caballo Reservoir.

1944 International Treaty – The 1944 International Treaty addresses the waters in the international segment of the Rio Grande from Fort Quitman, Texas to the Gulf of Mexico. The Treaty allocates water in the River based on percentage of flows in the River from each country's tributaries to the Rio Grande. The 1944 Treaty also stipulates that one-third of the flow of the Rio Conchos in Mexico is allotted to the United States. The Rio Conchos is by far the largest tributary of the Rio Grande. The treaty requires that the combined flow of the Rio Conchos and five other tributaries (San Diego, San Rodrigo, Escondido, Salado Rivers and Las Vacas Arroyo) shall have an annual average of not less than 350,000 acre-feet. The IBWC/CILA is responsible for implementing the treaties between the United States and Mexico. In previous years, the required minimum flow was not met.

3.1.1.2 Rio Grande Project and the El Paso County Water Improvement District #1

The Rio Grande Project is an irrigation storage and flood control federal reclamation project administered by the USBR. Elephant Butte and Caballo Reservoirs in southern New Mexico and the diversion dams at the headings of the main canals make up the Project's primary facilities. Built in 1915 and fed by the Rio Grande, Elephant Butte is the largest reservoir in New Mexico and provides water for approximately 90,000 acres of farmland. In the summer of 2013, Elephant Butte Reservoir dwindled to its lowest level in 40 years, and thus represents a drought of record in terms of irrigation-use impact.

The Project delivers water to the Elephant Butte Irrigation District (EBID) and the El Paso County Water Improvement District No. 1 (EPCWID#1). The EBID encompasses all the project lands in New Mexico south of the Caballo Reservoir and delivers water to farmlands in New Mexico. The Project also delivers water to Mexico in accordance with the Treaty of 1906. In 1979 and 1980, the two Irrigation Districts took over the operation and maintenance responsibilities of most of the respective irrigation works within the boundaries of each entity. Legal titles to the rights-of-way of irrigation canals and drains were transferred from the United States to the Districts in January 1996.

El Paso County Water Improvement District No. 1 – In Texas, the Rio Grande Project provides water for 69,010 acres of water-right lands, all of which are located within the boundaries of the EPCWID #1. The District contains 156 square miles, with over 350 miles of canals and laterals in the distribution system, and over 269 miles in the drainage system. Water is delivered through canals and laterals to more than 2,205 turnouts, irrigating crops of cotton, alfalfa, pecans, chilies, wheat, milo, vegetables, pastures and family gardens. Since 1941, EPCWID#1 has delivered water to the City of El Paso (El Paso Water) for municipal and industrial use through contracts among the District, the City and the USBR. The City of El Paso also owns farmland with first class water rights, which it uses for municipal purposes.

Project Water Allocation – Deliveries of Rio Grande Project water is based on irrigation requirements authorized for the Project and are agreed on by the two Irrigation Districts and the USBR. The annual allotment of Rio Grande Project water downstream of the Caballo Reservoir is determined by the USBR based on the amount of usable water in storage. Through data obtained from the measurement of snow pack and river gauging stations along the upper reaches of the Rio Grande, the USBR determines the projected inflow to Elephant Butte Reservoir. The USBR measures storage available in the Elephant Butte and Caballo Reservoirs and determines the volumes available for allocation.

Total releases from Project storage during a full-allotment year average approximately 764,000 acre-feet. Total diversions, however, average approximately 932,000 acre-feet per year. Total average diversions exceed average total releases by 168,000 acre-feet. The difference between the two is attributable to irrigation and municipal return flows, operation spills from upstream users, and rainfall runoff. Total diversion allocations are 495,000 acre-feet to EBID, 376,000 acre-feet to EPCWID#1, and 60,000 acre-feet to Mexico during years of full supply allocation.

Currently, the City of El Paso's (El Paso Water) right to use water from the Project arises from its ownership of 2,000 acres of land with rights to use water, approximately 5,542 acres of 50- and 75-year term City of El Paso Irrigation Water Assignments (Leases) for rights to use water from urbanized land parcels, and approximately 3,088 acres of Lower Valley Water District (LVWD) leases. The rights to use water from the LVWD leases are transferred to El Paso Water (EPW) on an annual basis in exchange for a wholesale supply of water from the city utility. EPW receives an annual allocation for water leased and land ownership categories based on the yearly allocation and the provisions of the respective 1941, 1962, 1989, and 2001 contracts. During a full allocation year, EPW has rights to divert 65,000 acre-feet of Rio Grande Project water from all contract sources. The conversion of rights to use water from agricultural to municipal and industrial use must be contracted with the EPCWID#1 and the USBR. EPW has also finalized an agreement with EPCWID#1 to acquire additional raw water based on EPCWID#1's operation of new shallow wells intended for drought relief. The 2001 Third Party Implementing Contract with EPCWID#1 converts to municipal and industrial use Project water saved from canal lining, operational efficiencies, and other miscellaneous water sources. EPW has also negotiated and agreed in principal on the terms of a Third Party Implementing Contract that would allow it to contract for the conversion of rights to use water directly from farmers through the use of short-term "Forbearance Contracts."

In recent decades, the amount of water released from Caballo Reservoir for the Rio Grande Project has been trending downward (Figure 3-2). The year with the least amount of flow below Caballo Dam was 2013, which was used to determine surface water availability from the Rio Grande Project for water users in Far West Texas. Releases from Caballo Reservoir are used to meet the needs of water users in New Mexico, Texas and Mexico, and so are higher than the amounts shown in Table 3-1. The flows have increased since 2013. For the purposes of regional water planning, the 2013 availability can be thought of as the new drought-of-record for the Rio Grande Project.

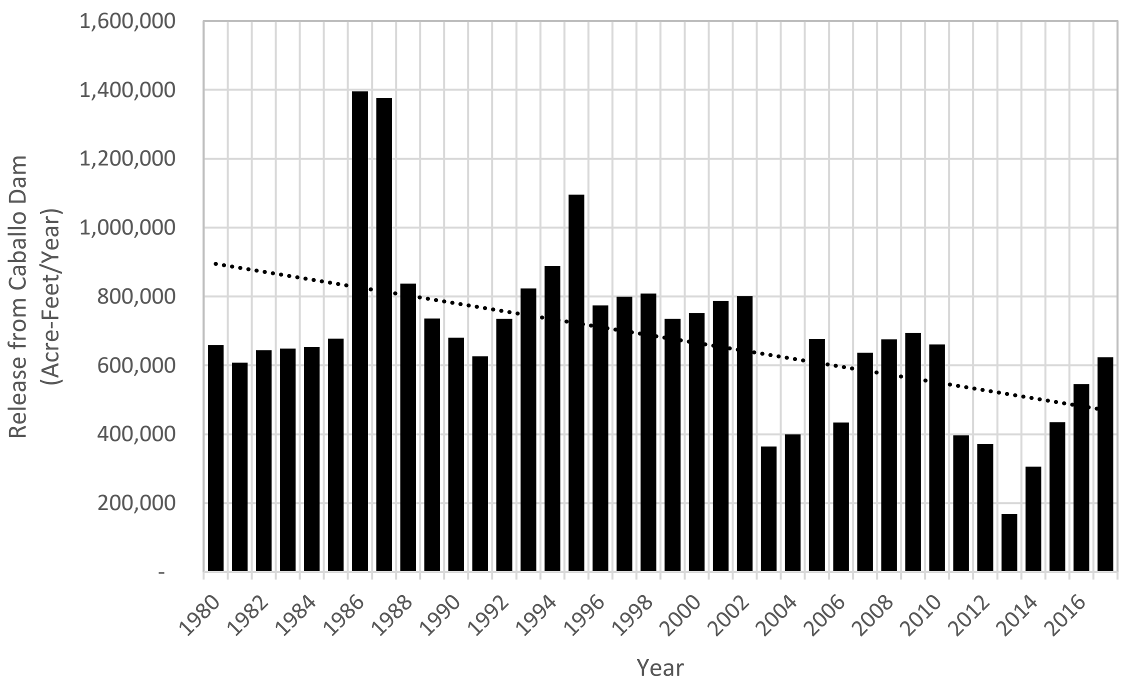

Figure 3-2. Annual Releases from Caballo Dam
(Data from 1980 to 2013 is from USGS Gage 08362500 Rio Grande Below Caballo Dam, NM. Data from 2014 to 2017 is from the USBR Water Information System)

The Rio Grande Water Availability Model (WAM) has a period of record from 1940 to 2000 and does not include the recent drought. In 2013, the USBR released 47,043 acre-feet of water for EPCWID#1 as part of the Rio Grande Project, which was lower than the amount indicated by the WAM. For this reason, the

2013 release was used as the available supply from the Project. Table 3-5 summarizes the allocation of water from the Rio Grande Project for water users in Far West Texas.

EPCWID#1 allocates the Rio Grande Project water to users in El Paso County and irrigators in Hudspeth County upstream of Fort Quitman. According to the WAM, users in El Paso County receive 99.068% of the Rio Grande Project water (46,605 acre-feet per year in 2013) and users in Hudspeth County upstream of Fort Quitman receive 0.931% of the allocation (438 acre-feet per year in 2013). Users in Hudspeth County downstream of Fort Quitman also receive water from the Rio Grande River, but not as part of the Rio Grande Project. This amount is 287 acre-feet per year according to the WAM, for a total of 725 acre-feet per year from the Rio Grande River for Hudspeth County (Table 3-1). In El Paso County, Rio Grande Project water is used by EPW and EPCWID#1. 10,000 acre-feet per year of the Rio Grande Project water reserved for El Paso County is allocated to EPW. The remaining 36,605 acre-feet per year stays with EPWID#1 for irrigation in El Paso County (Table 3-2 and Table 3-3).

Table 3-5. Supplies from Rio Grande Project
(Acre Feet per Year)

Water User Group	2020	2030	2040	2050	2060	2070
El Paso Water	10,000	10,000	10,000	10,000	10,000	10,000
El Paso County Irrigation	31,605	31,605	31,605	31,605	31,605	31,605
Hudspeth County Irrigation[1]	438	438	438	438	438	438
Total	**42,043**	**42,043**	**42,043**	**42,043**	**42,043**	**42,043**

[1.] Hudspeth County Irrigation also receives 287 acre-feet per year from water rights below Fort Quitman, which are not part of the Rio Grande Project.

3.1.1.3 Hudspeth County Conservation and Reclamation District No. 1

The HCCRD #1, headquartered in Fort Hancock, was created in 1924 to provide irrigation waters to 18,300 acres of Rio Grande bottomlands that are located downstream of the El Paso-Hudspeth County line to Fort Quitman. The District operates under a Warren Act contract and diverts tailwater, returns, and excess flows from the Rio Grande Project. Water reuse and recycling are its primary operations; the District does not provide potable water.

Water sources include untreated water from permitted Rio Grande diversions, drainage waters, return flows from farming operations, operational waste associated with the USBR's Rio Grande Project, and return flows from El Paso water and wastewater treatment plants. The supply to the District is completely dependent on the EPCWID #1 annual operations, and therefore can be unpredictable. When flows are erratic, the District utilizes drought contingency planning. If a mild to moderate shortage is predicted, users are notified of the expected shortage. For severe shortages, when supply is less than half of demand, agricultural producers are asked to prioritize water requests based upon crop needs.

3.1.1.4 Rio Grande Watermaster

Rio Grande water below Ft. Quitman is stored in two reservoirs located in the middle (Amistad) and lower (Falcon) segments of the River. A binational commission determines the allocation of these international waters between Mexico and the U.S. (Texas). The TCEQ Rio Grande Watermaster administers Texas' share of the international water in the Lower Rio Grande and its Texas tributaries, excluding the drainage basins of the Pecos and Devils Rivers.

3.1.1.5 Rio Grande Water Quality

The quality of water in the segment of the Rio Grande that flows through Far West Texas varies significantly from specific locations and season of the year. Of prime consideration is that there is little natural flow in the River. The TNRCC's (predecessor name of TCEQ) inventory of water quality in the state (TNRCC, 1996) cites drainage area and a wide range of geologic and climatic conditions in Far West Texas as factors responsible for water-quality conditions in the Rio Grande. Heavy metals and pesticides have been identified along the course of the Rio Grande. Elevated fecal coliform and nutrient levels occur in the River downstream of border cities, primarily because of untreated wastewater from Mexico. Additional discussion on Rio Grande water quality is provided in Chapter 1, Section 1.8.

3.1.1.6 Long-Term Reliability of the Rio Grande

The long-term reliability of Rio Grande water is sporadic. Aside from the legal mechanisms governing allocation of the water from Elephant Butte Reservoir and the allocation of water between the two nations of Mexico and the United States, the meteorologic and hydrologic reality is that the West Texas segment of the Rio Grande has its headwaters in a climatic region totally apart from the climatic regime of Far West Texas. If a drought occurs in Colorado, the El Paso area is essentially thrown into a drought-like scenario. As the science of drought prediction matures, it could become a useful source of information for modeling the long-term availability of water in the Rio Grande headwaters.

3.1.1.7 Rio Grande Channelization

In 1933, the United States and Mexico signed a Convention entitled, "Rectification of the Rio Grande", in which the two countries agreed to provide flood protection to urban, suburban and agricultural lands and stabilize the international boundary line. Construction work authorized by this Convention addressed channel aggrading due to the flat gradient and low velocities of the Rio Grande and the new channels that tended to form on lower ground during flood flows. The rectified channel between its upper end at Cordova Island, near El Paso, to its lower end reduced the original river channel length from 155.2 miles to 85.6 miles and increased the gradient from about two feet per mile to 3.2 feet per mile. The Rectification Project also included the construction of three toll-free bridges. Construction commenced in March 1934 and was completed in 1938. In June of 1987, the Riverside Dam failed. The EPCWID#1 constructed a temporary rock cofferdam immediately downstream of Riverside Dam as a temporary means of diverting irrigation water through Riverside Heading, with the stipulation that the temporary dam would be removed once the American Canal Extension, scheduled for completion in February 1999, was constructed.

The other important joint project with Mexico, the Rio Grande Boundary Preservation Project, carries out the provisions of Article IV of the 1970 "Treaty to Resolve Pending Boundary Differences and Maintain the Rio Grande and Colorado River as the International Boundary". The project covers the Rio Grande's 194-mile reach between Fort Quitman and Haciendita, Texas and addresses sedimentation as well as the phenomenon of salt cedars choking the channel. In some places the channel is nearly obliterated, and lands on both sides of the river are subject to periodic flooding from flash floods of tributary arroyos. The final Environmental Impact Statement for the Boundary Preservation Project was completed in 1978. In the United States, the Boundary Preservation Project was constructed in reaches based on contracts issued and inspected by the IBWC's United States Section.

Construction was completed for Reach I but was interrupted for other reaches by an extended period of flooding in 1981. Subsequent work done by IBWC's United States Section was tied to the Mexican Section's schedule; February of 1986 marked the end of U.S. Section construction work anywhere within the Boundary Preservation Project.

Funding to continue maintenance of the completed channel work has not been received since 1985; consequently, sediment plugs on the large tributary arroyos and high flows in the river have caused overtopping of the banks with the result that the channel has deviated from its original alignment. It is this deviation from channel alignment that concerns IBWC and which is properly termed "re-channelization". IBWC's perspective is that re-channelization of the Rio Grande is a treaty requirement, and that re-channelization offers some water salvage potential when combined with removal of salt cedar.

3.1.1.8 Forgotten River Reach of the Rio Grande

Reduced flows below Fort Quitman have resulted in a long stretch of the Rio Grande (locally known as the "Forgotten River") with no defined channel and riparian vegetation that has become a tamarisk thicket. The Rio Grande within this reach follows a sinuous channel for almost 200 river miles from about 13 miles downstream of Fort Quitman to about 6 miles upstream of Presidio. The high flows and periodic floods necessary to maintain the river channels have been reduced significantly over the past several decades.

In 2004, the TCEQ voiced concerns related to floodplain and riverine function, environmental resources, water quality, agriculture, and watershed hydrology. At the request of TCEQ, the Albuquerque Division of the US Army Corps of Engineers conducted a reconnaissance level investigation of the Forgotten River, which culminated in recommendations that the "Forgotten River Reach" study proceed into the feasibility phase to develop comprehensive watershed management recommendations. In response, several studies have been conducted that examine environmental resources, water supply, groundwater recharge, flooding and erosion, geology, cultural resources, and history. The latest feasibility study by the US Army Corps of Engineers, published in August 2007, provides recommendations pertaining to a needed systematic watershed approach to understanding the dynamics of the river environment. The study also presents an opportunity for local, state, and federal agencies to work together in developing solutions to managing the varied resources of the Forgotten River Reach.

3.1.1.9 Rio Grande Interstate Litigation

The Rio Grande is an interstate and international river that originates in Colorado, flows in a southerly direction into and through New Mexico and into Texas, where the River is a significant water resource in Far West Texas with far reaching economic and social ties to the Region. To ensure an equitable divide and apportionment of Rio Grande water, Colorado, New Mexico and Texas signed the Rio Grande Compact in 1938, which a year later was approved by the United States pursuant to an Act of Congress.

In 2013, the State of Texas brought a complaint against the State of New Mexico and the State of Colorado in the Supreme Court of the United States contesting that:

New Mexico has, contrary to the purpose and intent of the Rio Grande Compact, allowed and authorized Rio Grande Project water intended for use in Texas to be intercepted and used in New Mexico. New Mexico's actions, in allowing and authorizing the interception of Rio Grande Project water intended for use in Texas, violates the purpose and intent of the Rio Grande Compact, causing grave and irreparable injury to Texas.

New Mexico, through the actions of its officers, agents and political subdivisions, has increasingly allowed the diversion of surface water, and has allowed and authorized the extraction of water from beneath the ground, downstream of Elephant Butte Dam, by individuals or entities within New Mexico for use within New Mexico. The excess diversion of Rio Grande surface water and the hydrologically connected underground water downstream of Elephant Butte Reservoir adversely affects the delivery of water that is intended for use within the Rio Grande Project in Texas.

The Far West Texas Water Planning Group recognizes the potential impact of diminished water-supply availability from the Rio Grande from this interstate issue and encourages the State of Texas to continue its pursuit of rectifying the problem through whatever action is deemed most appropriate.

3.1.2 Pecos River

Originating in the Sangre de Cristo Mountains of northern New Mexico, the Pecos River flows 926 miles south into Texas, and discharges into the channel of the Rio Grande near the upper reaches of Amistad Reservoir. The Pecos is the largest Texas river basin that flows into the Rio Grande (Figure 3-1), contributing an average of 9.5 percent of the average annual streamflow into the Rio Grande. The River forms the easternmost border of the Far West Texas planning region along the northeast corner of Terrell County.

Pecos River flow is controlled by releases from Red Bluff Reservoir near the Texas–New Mexico state line, where storage in the reservoir is affected by the required delivery of water from New Mexico (see Section 3.1.2.1 below). Water released from Red Bluff is high in salt content and is used by downstream irrigators growing salt-tolerant crops. The Pecos contributes more than 26 percent of the annual salt load into Amistad Reservoir. Independence Creek in northern Terrell County is the principal contributor (42 percent) to Pecos flow in Texas and its fresh quality reduces the salt load in the River by 50 percent (see Section 3.1.2.3 below).

3.1.2.1 Pecos River Compact

Signed by Texas and New Mexico in 1948 and approved by Congress the following year, the Pecos River Compact provides for a Commission to administer the apportionment and diversion of Pecos River waters. The Compact repeatedly refers to the "1947 Condition," which is a Pecos River Basin situation defined in the Compact Commission's Report of the Engineering Advisory Committee. The terms of the Pecos River Compact can be summarized by the following four points:

- New Mexico cannot decrease the Pecos flow at the New Mexico/Texas border to a point less than that of the 1947 condition. (When determining the quantity of Texas water for the 1947 condition, waters of the Delaware River are apportioned to Texas.)
- Of the beneficial consumptive use of water salvaged in New Mexico on the River, Texas shall receive 43 percent and New Mexico 57 percent.

- Any water salvaged by beneficial use, but which is not beneficially consumed, shall be apportioned to New Mexico. Any water salvaged in Texas shall go to Texas.
- Beneficial consumptive use of unappropriated floodwaters shall go equally to Texas and to New Mexico.

The Pecos River Compact allows Texas and New Mexico to build additional reservoir capacity to replace unusable reservoir capacity, for the utilization of salvaged water and unappropriated floodwaters as apportioned by the Compact and for making more efficient use of water. Each state shall work with agencies to solve the salinity problem in the Pecos, and each may construct and operate facilities to prevent flood damage.

Texas and New Mexico were involved in a lawsuit over New Mexico's obligation to deliver water to Texas was decided and ordered by the U.S. Supreme Court in 1988 (485 U.S. 388). The decree requires New Mexico to abide by the terms of the Pecos River Compact, and resulted in the appointment of a Pecos River Master.

3.1.2.2 Water Allocation and Water Rights

Pecos water delivered to Texas is stored in Red Bluff Reservoir and is allocated by a master irrigation control district to seven other irrigation districts downstream; each district then apportions the waters to individual farmers. The irrigation districts are in Loving, Ward, Reeves and Pecos Counties, which lie in Far West Texas' neighboring Region F.

Within the reach of the Pecos that borders Far West Texas, the TCEQ water-rights master file lists five water rights on unnamed tributaries of the Pecos River (Certificates of Adjudication 5462 through 5466). These water-rights holders, located in Terrell County, are authorized to divert 873.25 acre-feet of water per year for irrigation purposes (Appendix 3A).

3.1.2.3 Significant Pecos River Basin Tributaries

Phantom Creek – Phantom Creek originates from groundwater discharging at Phantom Spring in Jeff Davis County. The Creek flows northeastward into Reeves County, where it gains additional flow from San Solomon, Giffin, Saragosa, East Sandia and West Sandia Springs. Surface flow in the Creek, however, does not reach the Pecos River, but rather infiltrates into the farm land south of the town of Pecos. Phantom Creek is a source of water for irrigation in southern Reeves County. The U.S. Bureau of Reclamation manages the spring property and holds two water rights for the annual diversion of as much as 18,900 acre-feet of water for irrigation, however, this volume is rarely available.

A study performed by the TWDB in 2003 reports that flow in Phantom Spring has experienced significant decline over the past several drought years, declining from more than 10 cubic feet per second (cfs) during the 1930s to less than 1cfs during the recent drought period. Recently Phantom Spring has ceased flowing on several occasions and a pump has been installed into the spring pool to support species residing at the spring outfall.

Independence Creek – Independence Creek, a large spring-fed creek in northern Terrell County, is the most important of the few remaining freshwater tributaries to the lower Pecos River. Caroline Spring flows at a rate of 3,000 to 5,000 gpm and comprises about 25 percent of the Creek's flow. Independence Creek's contribution increases the Pecos River water volume by 42 percent at the confluence and reduces the total suspended solids by 50 percent, thus improving both water quantity and quality (Nature Conservancy of Texas descriptive flier).

Independence Creek hosts a variety of bird and fish species, some of which are extremely rare. For the Proserpine shiner, Rio Grande darter, headwater catfish, and several other native fishes, Independence Creek is an important refuge during stressful Pecos River conditions. Following periods of low-water quality and occasional algae blooms on the Pecos River, fish populations in the clear waters of the Creek help to repopulate the River after a fish kill. The Nature Conservancy of Texas manages a significant portion of Independence Creek, including Caroline Spring, as a natural preserve. The reach of Independence Creek managed by the Nature Conservancy is recommended as an Ecologically Unique Stream Segment by the Far West Texas Water Planning Group.

3.1.2.4 Pecos River Watershed Protection Plan

The Pecos River is the lifeblood of many communities within its reaches, and serves as a major water source for irrigation, recreational uses, and recharge for underlying aquifers. However, the flows of the once great Pecos River have dwindled to a mere trickle due to natural and man-induced causes. Because water quality and streamflow has declined, the aquatic community of the Pecos River has been drastically altered. To address these river issues, the Pecos River Basin Assessment Program was initiated in 2004 by the Texas Water Resources Institute of Texas A&M University (http://pecosbasin.tamu.edu/). The project was funded by the Texas Soil and Water Conservation Board through the U.S. Environmental Protection Agency-Clean Water Act Grant. Components of the project include:

- A basin assessment of stream channel morphology, riparian vegetation, land use, salinity mapping, water inflows and outflows, aquatic habitats, historic perspectives and economic modeling.
- Educational programs working with various state and local agencies to assemble a series of publications and organize and a series of educational meetings targeted at landowners, stakeholders and policymakers in the Basin.
- Monitoring programs consisting of data collection, analysis, and water use studies intended to estimate the effect of salt concentration and fate of water salvaged through salt cedar control.

"A Watershed Protection Plan for the Pecos River in Texas" was published in 2008 and updated in 2013 (http://pecosbasin.tamu.edu/assessment-program/). The WPP for the Pecos River in Texas recommends management strategies that typically address more than one concern. The plan includes an in-depth overview that defines the watershed and its characteristics and provides some of the history behind the current issues. As a primer on management strategies, the WPP also discusses past and current uses of the river and watershed. Landowners' concerns about the Pecos River watershed are discussed, management strategies are recommended, costs are estimated, technical assistance is outlined, and timelines for implementing these strategies and a program to address each concern are included. The plan includes:

- Identification of the causes and sources of pollutants
- Estimation of expected pollutant reductions
- Identification of critical areas of the watershed
- Description of the management measures needed

- Estimation of the costs of technical assistance and sources of funding
- An information and educational outreach component
- A feasible implementation schedule
- Milestones to assess the effectiveness of plan implementation
- Criteria for assessing success
- A long-term monitoring effort

3.2 GROUNDWATER

Other than irrigation use and a portion of El Paso Water municipal use from the Rio Grande, almost all other water use in Far West Texas is supplied from groundwater sources. Although not as large in areal extent as some aquifers in the State, such as the Ogallala and the Carrizo-Wilcox, individual aquifers in Far West Texas are more numerous (10 TWDB designated and 3 Planning Group designated) than in any of the other planning regions state wide (Figure 3-3).

- Hueco Bolson
- Mesilla Bolson
- West Texas Bolsons
    - Salt Basin
        - Upper Salt Basin
        - Wild Horse and Michigan Flats
        - Lobo Flat
        - Ryan Flat
    - Presidio / Redford
    - Green River Valley
    - Red Light Draw
    - Eagle Flat
- Bone Spring-Victorio Peak
- Igneous (Davis Mountains Igneous)
- Edwards-Trinity (Plateau)
- Capitan Reef Complex
- Marathon
- Rustler
- Pecos Valley (Balmorhea Alluvium)

Other locally recognized groundwater sources:

- Rio Grande Alluvium
- Edwards-Trinity of Brewster County (Brewster Cretaceous)
- Diablo Plateau

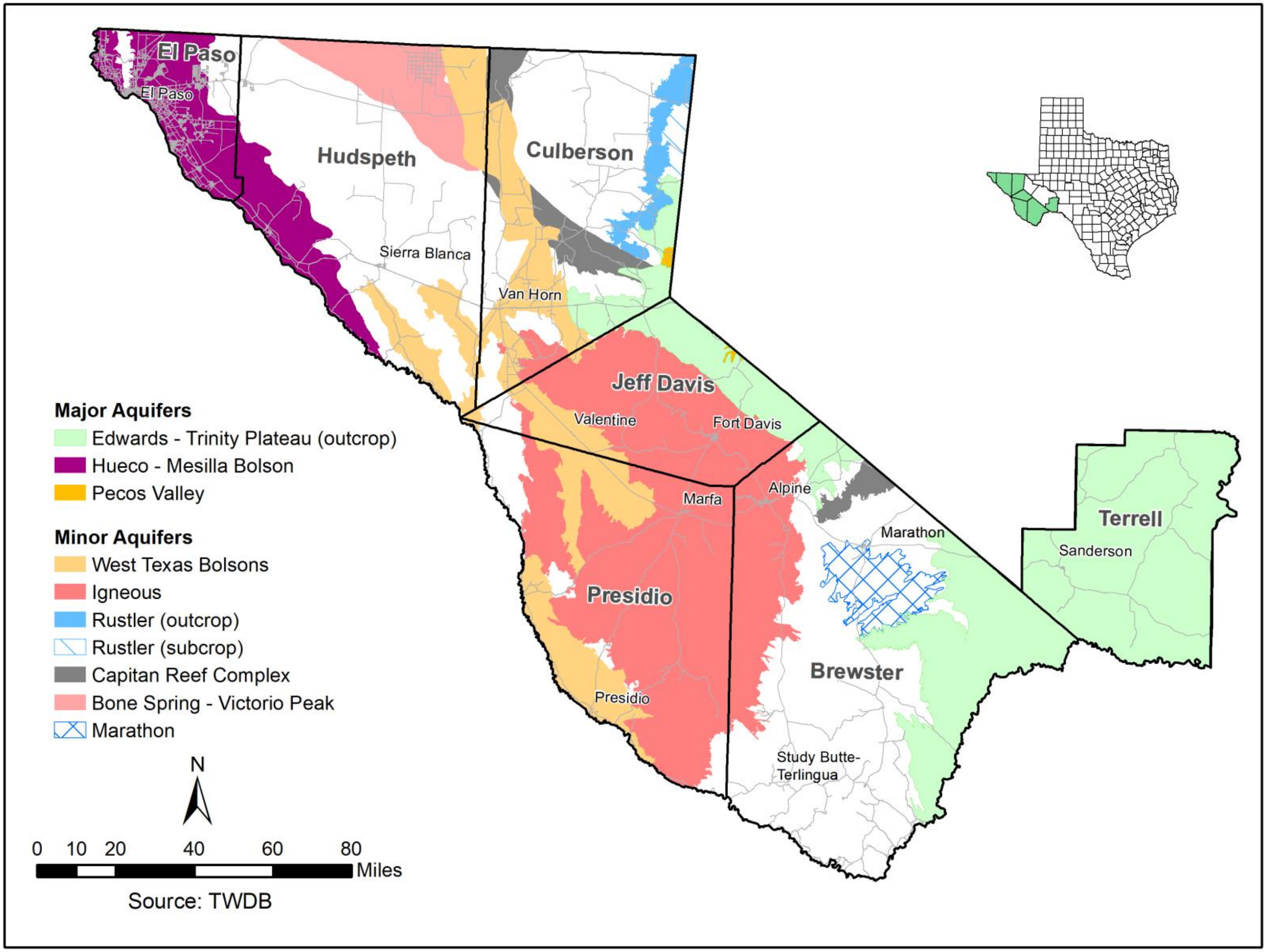

Figure 3-3. Major and Minor Aquifers

Aquifers in the Region can be categorized into three basic types; bedrock, bolson and alluvium. Bedrock aquifers are those where groundwater flows through permeable fractures in hard-rock formations (limestone, dolomite, volcanic basalt, etc.). Aquifers of this type include the Bone Spring-Victorio Peak, Capitan Reef, Edwards-Trinity, Rustler, Marathon, and Igneous. Bolson aquifers occur in thick silt, sand, and gravel deposits that fill valleys between the numerous mountain ranges. Bolson aquifers in the Region include the Hueco, Mesilla, and the various individual aquifers that comprise the West Texas Bolson Aquifer group. Alluvial aquifers occur in the floodplain deposits adjacent to riverbeds and are often hydrologically connected to the surface water body. The Rio Grande Alluvium Aquifer is in this category. Water quality characteristics of these aquifers are discussed in Chapter 1, Section 1.8.

The FWTWPG has continuously acknowledged the need to increase the reliability of groundwater availability estimates by supporting the acquisition of additional data that can be used to characterize the many aquifers in the Region. Interim TWDB funded projects were performed during previous planning periods in which new well data, water quality analyses, and aquifer parameters ascertained through pumping tests were developed. Project reports are accessible on the Rio Grande Council of Government website at http://www.riocog.org/ENVSVCS/FWTWPG/docs.htm.

- Igneous Aquifer System of Brewster, Jeff Davis and Presidio Counties, Texas (2001)
- West Texas Bolsons and Igneous Aquifer System Groundwater Availability Model Data Collection (2003)
- Groundwater Data Acquisition in Far West Texas (2009)
- Groundwater Data Acquisition and Analysis for the Marathon and Edwards-Trinity (Plateau) Aquifers (2010)

The evaluation of groundwater availability as reported in this *2021 Plan*, including MAG volumes and local analyses, is based on previous geohydrologic studies, groundwater data including historical use contained in state and federal databases, and groundwater availability models (GAMs). Regardless of the specific method used to calculate groundwater supply availability, all analyses include the consideration of four basic components: (1) recharge to the aquifer, (2) recoverable storage capacity within the aquifer, (3) lateral movement into and out of the aquifer, and (4) withdrawals from the aquifer. Table 3-6 lists the methodologies used to estimate total groundwater source availability as reported in Table 3-1. Table 3-7 lists the "desired future conditions" established by groundwater conservation districts for their assigned Groundwater Management Areas. These aquifer conditions are used to assess the Modeled Available Groundwater (MAG) supply availability for designated aquifers.

Table 3-6. Groundwater Source Availability Methodology

Water Supply Source	County	Methodology
Hueco-Mesilla Bolson	El Paso	One percent of total calculated volume in storage minus Hudspeth ten percent from Hutchison model.
	Hudspeth	Ten percent of total calculated volume in storage from Hutchison model.
Edwards-Trinity (Plateau)	Brewster	MAG
	Culberson	GCD Non-Relevant. TWDB modeled run compatible with DFC, which was provided to the FWTWPG for consideration.
	Jeff Davis	
	Terrell	MAG
Bone Spring - Victorio Peak	Hudspeth	MAG
Capitan Reef Complex	Brewster	MAG
	Culberson	
	Jeff Davis	GCD Non-Relevant TWDB-Null
	Hudspeth	GCD Non-Relevant (TWDB-Null). Max 8-year historical annual use.
Igneous	Brewster	MAG
	Culberson	
	Jeff Davis	
	Presidio	
Marathon	Brewster	MAG
Rustler	Brewster	GCD Non-Relevant. TWDB modeled run compatible with DFC, which was provided to the FWTWPG for consideration.
	Culberson	
	Jeff Davis	
West Texas Bolson (Red Light Draw)	Hudspeth	GCD Non-Relevant. GAM recharge from TWDB Contract Report (June 2004).
West Texas Bolson (Eagle Flat)	Hudspeth	
West Texas Bolson Green River Valley)	Hudspeth	
West Texas Bolson (Green River Valley)	Jeff Davis	
West Texas Bolson (Green River Valley)	Presidio	
West Texas Bolson (Presidio-Redford)	Presidio	MAG
West Texas Bolson (Upper Salt Basin)	Hudspeth	GCD Non-Relevant. Max 8-year historical annual use.
	Culberson	GCD Non-Relevant (TWDB-Null). TWDB Report AA 10-38 MAG.
West Texas Bolson (Wild Horse, Michigan and Lobo)	Culberson	MAG
West Texas Bolsons (Ryan)	Jeff Davis	MAG
	Presidio	
Other Aquifer (Brewster Cretaceous)	Brewster	RWPG Assigned. Max 8-year historical annual use.
Other Aquifer (Diablo Plateau)	Hudspeth	RWPG Assigned. Recharge rate of 3% of average annual rainfall (11 inches/yr) over 1,500 square miles of outcrop.
Other Aquifer (Balmorhea Alluvium)	Jeff Davis	RWPG Assigned. 2017 reported use by GCD.
Other Aquifer (Rio Grande Alluvium)	El Paso	RWPG Assigned. Max 8-year historical annual use.
	Hudspeth	RWPG Assigned. Max 8-year historical annual use.

Table 3-7. GMA Aquifer Desired Future Conditions

GMA	Aquifer	County	Desired Future Condition for the Period from 2010-2060
4	Bone Spring - Victorio Peak	Hudspeth	0-feet drawdown averaged across the portion of the aquifer within the boundaries of the district
	Capitan Reef Complex	Brewster	0-feet drawdown
		Culberson	50-feet drawdown
		Jeff Davis	Non-relative
		Hudspeth	Non-relative
	Edwards-Trinity (Plateau)	Brewster	3-feet drawdown
		Culberson	Non-relative
		Jeff Davis	Non-relative
	Igneous	Brewster	10-feet drawdown
		Culberson	66-feet drawdown
		Jeff Davis	20-feet drawdown
		Presidio	14-feet drawdown
	Marathon	Brewster	0-feet drawdown
	Rustler	Brewster	Non-relative
		Culberson	Non-relative
		Jeff Davis	Non-relative
	West Texas Bolsons (Wildhorse, Michigan, & Lobo Flats)	Culberson	78-feet drawdown
	West Texas Bolsons (Ryan Flat)	Jeff Davis	72-feet drawdown
		Presidio	72-feet drawdown
	West Texas Bolsons (Presidio & Redford Bolsons)	Presidio	72-feet drawdown
	West Texas Bolsons (Upper Salt Basin)	Culberson	Non-relative
		Hudspeth	Non-relative
	West Texas Bolsons (Eagle Flat)	Hudspeth	Non-relative
	West Texas Bolsons (Green River Valley)	Hudspeth	Non-relative
		Jeff Davis	Non-relative
		Presidio	Non-relative
	West Texas Bolsons (Red Light Draw)	Hudspeth	Non-relative
	Brewster Cretaceous	Brewster	FWT declared aquifer
	Diablo Plateau	Hudspeth	FWT declared aquifer
	Pecos Valley (Balmorhea Alluvium)	Jeff Davis	FWT declared aquifer
	Presidio Cretaceous	Presidio	FWT declared aquifer
5	Hueco-Mesilla Bolson	El Paso	Non-DFC
		Hudspeth	Non-DFC
	Rio Grande Alluvium	El Paso	FWT declared aquifer
		Hudspeth	FWT declared aquifer
7	Edwards-Trinity (Plateau)	Terrell	7-Feet drawdown

3.2.1 Hueco Bolson Aquifer

The Hueco Bolson Aquifer is a major source of groundwater for cities in El Paso and Hudspeth Counties, as well as Ciudad Juarez, Mexico. The Hueco Bolson extends southeastward from the Franklin Mountains in El Paso County to the southern end of the Quitman Mountains in Hudspeth County. The eastern boundary of the bolson is established by the Diablo Plateau in El Paso and Hudspeth Counties and the Malone and Quitman Mountains in Hudspeth County. Northward, the Hueco extends into New Mexico where it is hydrologically connected to the Tularosa Basin Aquifer. The Hueco Bolson also extends southward into the Mexican State of Chihuahua, where it is bounded by a series of mountain ranges that trend toward the southeast from Ciudad Juarez to near the southernmost point of the Quitman Mountains in Texas.

The Hueco Bolson consists of deposits of basin fill with a maximum thickness of approximately 10,000 feet along its western edge. The upper part of the basin fill consists of silt, sand and gravel. The lowermost deposits are made up largely of clay and silt. Only portions of the upper several hundred feet along the western edge of the bolson fill are known to contain fresh to slightly saline water. East and below the fresh water zone, the aquifer contains large volumes of brackish quality groundwater, which is currently being desalinated for public supply use by EPW and Horizon MUD. Where Hueco Bolson sediments directly underlie Rio Grande alluvial sediments, the two units are hydrologically connected. Recent data analysis and computer modeling indicate that the Hueco Bolson Aquifer can continue to be sustainably developed well beyond previous estimates.

The TWDB official designations the Hueco and Mesilla Bolsons as a single major-aquifer system (Figure 3-3) and reports its combined source availability in El Paso and Hudspeth Counties as a single volume, 480,000 acre-feet per year (Table 3-1). However, the two bolsons are not hydrologically connected. For this 2021 *Plan*, The Hueco and Mesilla Bolsons Aquifer is subdivided as follows:

El Paso County:

Hueco Bolson – 410,000 af/y

Mesilla Bolson – 25,000 af/y

Hudspeth County:

Hueco Bolson – 45,000 af/y

3.2.2 Mesilla Bolson Aquifer

The Mesilla Bolson Aquifer is located west of the Franklin Mountains and is part of a larger bolson that extends from southern New Mexico to northern Mexico. The bolson deposits consist of approximately 2,000 feet of clay, silt, sand, and gravel. Three water-bearing zones have been identified based on water levels and quality. The shallow zone includes the overlying Rio Grande Alluvium. El Paso Water maintains a municipal wellfield in the Mesilla Bolson Aquifer near Canutillo. For the 2021 *Plan*, Mesilla Bolson source availability is estimated to be approximately 25,000 acre-feet per year (see Hueco Bolson availability above).

3.2.3 West Texas Bolsons Aquifer

3.2.3.1 Salt Basin Bolson

The Salt Basin is the largest of the West Texas Bolson Aquifers extending from the New Mexico state line on the western side of the Guadalupe Mountains southward to near Marfa in northern Presidio County. The basin is subdivided into five distinct but hydrologically connected areas referred to as "flats" that contain significant quantities of groundwater that are being produced for municipal, irrigation, and livestock use. These sub-aquifers include from north to south Upper Salt, Wild Horse, Michigan, Lobo, and Ryan Flats. Water supplies used by the oil and gas industry is derived from this aquifer source.

Upper Salt Basin is not currently identified as part of the TWDB-designated West Texas Bolsons Minor Aquifer system, but is listed here because it is recognized as a source supply for specified water-user categories in this *Plan*. The Upper Salt Basin is the northern extension of Wild Horse Flat and is described separately because of a difference in water quality and primary use. The aquifer generally produces brackish to slightly saline groundwater to low-capacity wells primarily serving livestock needs.

Wild Horse Flat and Michigan Flat lie to the south of the Upper Salt Basin and are hydrogeologically interconnected with the northernmost part of Lobo Valley. Mountains bound the Wild Horse-Michigan Flat area along its western, eastern and southeastern margins. The Wild Horse-Michigan Flat watershed covers an area of approximately 1,000 mi^2 with a storage area of approximately 375 mi^2. The Wild Horse Flat area of the basin is a source of municipal supply for the Towns of Van Horn (Culberson County) and Sierra Blanca (Hudspeth County). The Wild Horse-Michigan Flat Aquifer is a major source of domestic and stock water for ranches and of irrigation water for farms in the valley.

Lobo Flat lies southwest of Wild Horse and Michigan Flats and is bound by mountains along its western and eastern margins. The bolson watershed covers an area of 350 mi^2, with a groundwater storage area of 130 mi^2. The largest part of the storage area (75 mi^2) is in Culberson County, and a smaller part (55 mi^2) lies within Jeff Davis County. The bolson is not a source of municipal supply, however, it is a source of domestic and stock water for ranches and a significant source of irrigation water.

Ryan Flat is the southernmost extension of the Salt Basin. The bolson watershed covers an area of 1,410 mi^2, and the storage area is 525 mi^2. The largest part of the storage area (360 mi^2) is in Presidio County, and a smaller area (165 mi^2) extends northward into Jeff Davis County, where it is the source of municipal supply for the Town of Valentine. It is also the source of domestic water, stock water for ranches, and a source of irrigation water for farms. Well completion information and pumping records from the Antelope Valley Ranch owned by EPW indicate that a zone of saturated, permeable, fractured volcanic rocks from 1,000 to as much as 3,000 feet thick underlies the bolson fill in Ryan Flat.

3.2.3.2 Presidio-Redford Bolson

In Texas, the Presidio-Redford Bolson extends along the Rio Grande from Candelaria to outcrops of volcanic rocks 6 to 10 miles southeast of Presidio. The Redford extension of the bolson continues along the Rio Grande for another 12 miles. The bolson is bounded along the northeast by the Chinati Mountains and along the southeast by the Cienega Mountains, the Black Hills, and the Bofecillos Mountains. This is an area of approximately 480 mi^2. Saturated thickness is conservatively estimated to be 500 feet beneath this area. The Presidio-Redford Bolson is the source of municipal supply water for the Town of Presidio and the Mexican community of Ojinaga. It is also the source supply for domestic, irrigation and livestock use.

3.2.3.3 Green River Valley Bolson

The Green River Valley Bolson lies in parts of Hudspeth, Jeff Davis and Presidio Counties. It is bordered by the Eagle Mountains on the west, the Van Horn Mountains on the east, and the Rio Grande on the south. The Green River Valley watershed covers an area of 160 mi^2, however the storage area is only 40 mi^2. Green River Valley is the smallest of the West Texas Bolsons and is a source of water only for ranches in the basin. A few abandoned wells give witness to a history of irrigation.

3.2.3.4 Red Light Draw Bolson

Red Light Draw, located in Hudspeth County, is situated between the Eagle Mountains along the north-northeast and the Quitman Mountains along the southwest. The Rio Grande is the southern border of the basin. The drainage area of the Red Light Draw watershed is estimated to be 370 mi^2 and an aquifer area of 185 mi^2. The Red Light Bolson is a source of water only for ranches in the basin, and at its southern end for a research station operated by the University of Texas at El Paso.

3.2.3.5 Eagle Flat Bolson

The Eagle Flat Bolson, located in Hudspeth County, is situated between the Eagle Mountains along the south-southwest, the Diablo Plateau along the north, and the Carrizo and Van Horn Mountains along the east. The drainage area of the bolson watershed is estimated to be 560 mi^2 and the basin fill covers an area of 156 mi^2. Only the southeastern part of the basin is regarded as having potential for the development of groundwater resources. The Eagle Flat Bolson is not a source of supply for municipalities in Hudspeth County. The unincorporated Town of Sierra Blanca, located in the western region of the basin, obtains water from a wellfield operated by the Town of Van Horn in Wild Horse Flat.

3.2.4 Bone Spring-Victorio Peak Aquifer

The Bone Spring-Victorio Peak Aquifer underlies the Dell Valley area of northeastern Hudspeth County between the Salt Flat Basin and the Guadalupe Mountains on the east and the Diablo Plateau on the west. The aquifer, which extends northward into the Crow Flats area of New Mexico, is used primarily for irrigation, but is also the public water supply source for Dell City. In 2007 the TWDB significantly enlarged the designated area of the aquifer to a total of 710 mi^2 by extending its western and southern boundary.

The aquifer consists of carbonate rocks (limestone and dolomite) of early Permian age. Groundwater in the aquifer occurs under water-table conditions in interconnected solution cavities of variable size and dimension that formed along joints, fractures and bedding planes. Water-bearing zones have been encountered in wells as deep as 2,000 feet. The productivity of a well completed in the aquifer is dependent on the number and size of cavities penetrated by the well bore. Well yields are reported to range from 150 gpm to as much as 4,000 gpm. The depth to groundwater within the irrigated region of Dell Valley ranges from approximately 35 feet along the eastern side of the valley to 325 feet on the west. Although the water table has declined since pre-development, static water levels have remained relatively constant since the late 1970s.

There are four principal components of recharge to the Bone Spring-Victorio Peak Aquifer:

- Precipitation that falls over watersheds that drain toward Dell Valley infiltrates rapidly along fractures and solution features such as sinkholes;

- The Sacramento River, which drains the Sacramento Mountains of New Mexico, discharges large volumes of water to the subsurface in the lowlands that border the mountain catchments;
- Lateral inflow of groundwater from areas to the north and the west; and
- Return flow from irrigation in Dell Valley.

During the irrigation season, the direction of groundwater flow is highly influenced by pumping wells, which create cones of depression in the water table. If pumping rates were not managed, significant water-level declines could result in highly saline water from the Salt Flats migrating westward into the fresher zones. However, chemical analyses of wells along the eastern border of the valley have not indicated a significant influx of saline water. The Hudspeth County Groundwater Conservation District engages management rules to insure the water table remains at a sustainable level.

3.2.5 Igneous Aquifer (Davis Mountains Igneous)

The Igneous Aquifer system comprises all contiguous Tertiary igneous (volcanic) formations underlying the Davis Mountains and adjacent areas primarily in Brewster, Jeff Davis and Presidio Counties. Most of the aquifer's areal extent is underlain by a thickness ranging from 1,000 to 4,000 feet; however, most wells are less than 1,000 feet in depth. The aquifer is not a single homogeneous aquifer but rather a system of complex water-bearing formations that are in varying degrees of hydrologic communication.

The extent of the Igneous Aquifer as illustrated in Figure 3-3. Major and Minor Aquifers represents a new boundary established in recent studies of the aquifer system. Groundwater is stored in the fissures and fractures of intrusive and extrusive rocks of volcanic origin. The chemical quality of the aquifer is generally good to excellent and well yields generally range from small to moderate.

Over 40 separately named volcanic units have been identified, each of which are highly variable in nature. Water quality of the aquifer is relatively good and generally meets safe drinking water standards. Alpine, Marfa and Fort Davis, along with a growing rural population, derive their municipal supplies from this aquifer.

3.2.6 Edward-Trinity (Plateau) Aquifer

The Edwards-Trinity (Plateau) Aquifer in Far West Texas is the westernmost extension of a vast groundwater system that underlies the Edwards Plateau east of the Pecos River and the Stockton Plateau west of the River. The aquifer is exposed over an area of 4,690 mi^2 in Terrell (2,350 mi^2), Brewster (1,460 mi^2), Jeff Davis (530 mi^2) and Culberson (350 mi^2) Counties. It is the source of municipal water for the City of Sanderson (Terrell County); a source of domestic water in Brewster, Culberson, and Terrell Counties; a source of irrigation water in Brewster and Terrell Counties; a source of stock water in all four counties; and a source of water for oil and gas operations in Terrell County.

The aquifer consists of saturated sediments of the Cretaceous age Trinity Group formations and the overlying carbonate rocks (limestone and dolomite) of the Comanche Peak, Edwards, and Georgetown formations. Groundwater occurs under water-table conditions in the four Far West Texas counties.

The hydrogeology of the Edwards-Trinity (Plateau) Aquifer in Far West Texas is not understood as well as in areas to the east, where the aquifer is a major source of supply for the municipal, industrial and agricultural sectors of the economy.

3.2.7 Capitan Reef Complex Aquifer

The Capitan Reef formed along the margins of the Delaware Basin, a Late Paleozoic sea. In Texas, the reef formed along the western and eastern edges of the basin in arcuate strips 10 to 14 miles wide. The reef is exposed in the Guadalupe and Apache Mountains of Culberson County and in the Glass Mountains of Brewster County. In other areas, the reef is found only in the subsurface. It extends northward into New Mexico, where it is a source of fresh water for the City of Carlsbad. The Capitan Reef Aquifer is composed of up to 2,000 feet of massive to cavernous dolomite and limestone, bedded limestone and reef talus. In many areas of Culberson and Hudspeth Counties, the yields of wells are commonly more than 1,000 gpm. Further to the south, in the Apache Mountains of Culberson County, well yields appear to be in the range of 400 gpm. There is no reported production data for the Glass Mountains portion of the Capitan Reef.

The aquifer is not currently a source of municipal supply; however, El Paso Water Utilities owns land over the aquifer in Culberson County and may tap the aquifer for municipal supply in the future. Most of the groundwater pumped from the aquifer in Far West Texas is used for irrigation in Culberson and Hudspeth Counties.

3.2.8 Marathon Aquifer

The Marathon Aquifer is located entirely within the north-central area of Brewster County, where it is the source of municipal supply for the Town of Marathon, and of domestic and stock water for ranches in the area. The Marathon area is underlain by complexly faulted and folded Paleozoic rocks having a total thickness of 21,000 feet and occupy an area of approximately 390 mi^2. The most significant water-bearing formation of the aquifer is the Marathon Limestone (early Ordovician age).

Groundwater in the Marathon Aquifer generally occurs under unconfined conditions in crevices, joints and cavities; however artesian conditions are common in areas where the Paleozoic rocks are buried beneath younger formations. Existing water wells have penetrated up to 900 feet, however most wells are generally less than 250 feet deep. Many of the shallow wells in the area actually produce water from alluvial deposits that overlie rocks of the Marathon Aquifer. The depth to groundwater is generally less than 150 feet, and depths of less than 50 feet are not uncommon. Groundwater in the aquifer is typically of good quality but hard.

3.2.9 Rustler Aquifer

The Rustler Aquifer located in eastern Culberson County is exposed in a southwest-trending belt that begins at the northeast corner of the county. The aquifer dips toward the east, and is found in the subsurface in easternmost Culberson County and Jeff Davis County. Approximately 803 mi^2 of land in Far West Texas are underlain by the Rustler Aquifer. The Rustler Aquifer is a source of water for irrigation and livestock. High concentrations of dissolved solids render the formation unsuitable as a source of municipal and domestic supply. The Rustler Aquifer consists mainly of dolomite, limestone, and gypsum of the Rustler Formation (Permian age). Groundwater is produced primarily from solution channels, caverns and collapsed breccia zones. The aquifer is under water-table conditions in the outcrop recharge zone in eastern Culberson County and is under artesian conditions elsewhere.

3.2.10 Pecos Valley Aquifer (Balmorhea Alluvium)

The Balmorhea Alluvium Aquifer, located in a small area along the Jeff Davis and Reeves county line, is recognized in this *Plan* due to its use as a municipal supply source for the City of Balmorhea and the Madera Valley WSC. The TWDB classifies this area as belonging to the Pecos Valley Aquifer; however, the erosion-derived gravel sequence is much unlike the sand and silts of the Pecos Valley Alluvium, and recharge is also unique to runoff from the slopes of the Davis Mountains.

3.2.11 Other Groundwater Resources

Also shown in Figure 3-3. Major and Minor Aquifers are large areas of Far West Texas that are depicted as not underlain by major or minor aquifers. The map, however, should not be interpreted as an indication that such areas are devoid of groundwater, but rather as a reflection of the current level of understanding of the extent of known groundwater resources in the Region.

Rio Grande Alluvium Aquifer

The Rio Grande Alluvium forms the flood plain of the Rio Grande in El Paso and Hudspeth Counties. Averaging approximately 200 feet in thicknesses, the alluvial aquifer is hydrologically connected to the underlying Hueco Bolson. TWDB Report 246 states that the Rio Grande Alluvium Aquifer within El Paso County contains about 1.4 million acre-feet of theoretically recoverable groundwater having less than 2,500 mg/l dissolved solids. Groundwater contained within the Rio Grande alluvial sediments generally has high concentrations of dissolved solids (typically greater than 2,000 mg/l), and requires desalination to meet drinking-water standards. However, it is a source of irrigation water in El Paso and Hudspeth Counties whenever flow in the Rio Grande is insufficient to support agricultural operations. These irrigation wells are capable of annually producing approximately 80,000 acre-feet in El Paso County and 15,000 acre-feet in Hudspeth County from the Aquifer. In addition, the Horizon Regional MUD pumps alluvial groundwater for municipal use, which must be desalinated to meet safe drinking water standards.

For this *Plan*, groundwater availability from the Rio Grande Alluvial Aquifer in El Paso County is calculated as 89,330 acre-feet per year effective recharge plus 5 percent of water in storage to a depth of 200 feet and with a salinity range of 1,000 to 2,000 mg/l (TWDB Rept. 246), or 130,380 acre-feet per year. Groundwater availability from the Aquifer in Hudspeth County is estimated at approximately 11.5 percent of that in El Paso County, or 15,000 acre-feet per year.

Edwards-Trinity Aquifer of Brewster County (Brewster Cretaceous)

In southern Brewster County, the small communities of Study Butte and Terlingua, as well as the Lajitas Golf Resort, obtain groundwater from underlying Cretaceous formations that are geologically equivalent to the Edwards-Trinity (Plateau) Aquifer. Wells recently drilled to supply water for the Lajitas golf courses have demonstrated that groundwater of likely significant quantity is present in this aquifer system. However, very little data has been collected pertaining to this aquifer. The Lajitas' wells are relatively deep, the temperature of the water is warm, and the water contains elevated radioactivity. The FWTWPG recommends that this aquifer be studied in more detail.

Diablo Plateau Aquifer

The Permian and Cretaceous rock formations that make up the subsurface of the Diablo Plateau of central and northern Hudspeth County may have large volumes of groundwater in storage. Although the aquifer system has not been adequately researched, Hutchison (2008) included a portion of this aquifer system in a flow simulation model of the Bone Springs-Victorio Peak Aquifer. Also, several wells have been drilled that testify to the existence of an underground supply.

For this *Plan*, groundwater availability for the eastern and southern portion of the Diablo Plateau is conservatively calculated as 26,400 acre-feet per year effective recharge based on three percent (drought rate) of average annual rainfall (11 inches) times the areal extent of the designated portion of the aquifer (1,500 mi^2 or 960,000 acres).

3.2.12 Groundwater Conditions in Municipal Wellfields

3.2.12.1 Brewster County

City of Alpine – The City of Alpine operates 13 active and 4 backup municipal supply wells in three wellfields (the Musquiz, Sunny Glen, and Town wellfields). Water levels have remained relatively stable near the wellfields, and there are no reported major water quality problems. The Musquiz field produces approximately two thirds of the City's municipal water, but the Sunny Glen field is regarded as having greater storage capacity. Several wells within the Sunny Glen field have been deepened, and yields are reported to have increased from less than 100 gpm to as much as 500 gpm. The City is actively upgrading both its wellfields and its distribution system.

Community of Marathon – The Marathon Water and Sewer Service Corporation provides water to the Community of Marathon from two wells screened in the Marathon Aquifer. Water levels have remained stable in the vicinity of the Community, and there are no reported major water quality problems. There are no other sources of groundwater near the Community.

Communities of Terlingua and Study Butte – The Study Butte Water Supply Corporation, which provides water to the towns of Study Butte and Terlingua, has developed two wells into the Cretaceous Santa Elena Limestone with the capacity of either well to sufficiently supply daily needs. Water levels have remained relatively stable, but little is known about how high-production wells into the same formation 10 miles away might affect local static water levels. Radiological activity in the untreated water consists mainly of Radon gas and radium 226, which are present in levels barely above detection limits. Radon levels are drastically reduced by mechanically assisted gassing, and the particulate R226 can be filtered out in such a quantity as to leave both an excellent product water and to pose no problems for disposal. This water system has one of the most sophisticated rural public water treatment facilities in West Texas, combining reverse osmosis desalination and other more traditional technologies to produce a product of superior taste and quality. The Study Butte WSC is currently requesting TWDB funding to install radio-read meters and the installation of 4,500 feet of 4-inch water line.

Resort of Lajitas – The Resort of Lajitas currently relies on two deep, large-bore wells of varying water quality drilled into Cretaceous formations. Depending on location, wells have demonstrated artesian characteristics, with completed static level as much as 700 feet above the level where the formation was entered. The water is chemically similar to that found 10 miles away by the Terlingua-Study Butte WSC, and poses similar treatment problems. Most water produced by the Lajitas Resort water system is for golf course and turf irrigation from a combination of sources. A state-of-the-art electro-dialysis desalination plant provides high quality product for municipal use by residents, employees, and resort guests. No change in aquifer levels has been reported since the onset of high volume pumping in 2000, but little reliable data is available for either recharge rates or total pumping volumes.

3.2.12.2 Culberson County

Town of Van Horn – Municipal supply for the Town of Van Horn is derived from four active city-owned wells in the Wild Horse Flat Aquifer. Water levels near Van Horn have remained stable. Other than fluoride concentrations that have been reported to range from 2.3 to 3.1 mg/l, all other dissolved constituents are within their respective safe drinking-water standards. The current wellfield has significant expansion capability if additional production is needed to meet increased demand. The City is replacing all water meters to better monitor water use.

3.2.12.3 El Paso County

City of El Paso (El Paso Water) and Vicinity – The production of groundwater from wellfields in the vicinity of El Paso and in Ciudad Juarez has created a large cone of depression in the potentiometric surface beneath each city. Average declines in wells in the upper portion of the Lower Valley in El Paso are more than 100 feet. These declines, in combination with deteriorating water quality, have prompted El Paso Water (EPW) to discontinue pumping from certain wells. Elsewhere, average water-level declines are generally in the range of 60 to 80 feet. Recent water-level data indicate a slight rise of water levels in the valley. This is probably traceable to lower pumpage in some areas. The lowering of the potentiometric surface not only has reversed the predevelopment hydraulic gradient in the westernmost regions of the Hueco Bolson, but also is a factor underlying the deterioration of water quality in part of the El Paso area.

The concentrations of chloride and other dissolved ions have increased in many of the municipal wells of both cities. In El Paso County, for example, the TDS in production wells has risen to more than 1,000 mg/l. In recent years, EPW has taken approximately 30 wells out of service due to elevated levels of chloride and TDS. In many cases, the greatest increases in TDS are associated with wells that have had large, sustained drawdowns, but similar changes have also been observed in some wells from which much less pumping has occurred. To continue the use of some of the more brackish quality wells, EPW has installed skid-mounted desalination equipment. EPW and El Paso County Tornillo WID are installing treatment facilities to mitigate elevated arsenic levels in groundwater supplies.

3.2.12.4 Hudspeth County

Community of Sierra Blanca – Water provided to the Community of Sierra Blanca by the Hudspeth County Water Control and Improvement District #1 is from a well located near the airport northwest of the Town of Van Horn in Culberson County. The well produces groundwater from the Wild Horse Flat Aquifer where water levels near the well have remained relatively constant and water quality has been acceptable. Groundwater from the well feeds into the Van Horn water supply and from there is diverted by pipeline to Sierra Blanca under a contract between the District and the City of Van Horn. There is substantial room for expansion if an additional well is needed to meet increased demand. Also, a larger diameter pipeline is being considered for transporting this water to Sierra Blanca. Since 1970, Sierra Blanca has drilled as many as five wells near the town in unsuccessful attempts to develop local sources of groundwater.

City of Dell City – Dell City relies on three wells (only one of which is currently active) completed in the Bone Spring-Victorio Peak Aquifer for municipal water, which is brackish and must be desalinated. The Bone Spring-Victorio Peak Aquifer is capable of supporting production from additional municipal supply wells if needed.

Communities of Fort Hancock and McNary – Fort Hancock and McNary have relied on groundwater provided by one well owned by the Fort Hancock WCID and on 11 wells owned by the Esperanza FWSD#1. All production is from the Rio Grande Alluvium Aquifer. Water levels fall in response to extended drought conditions in the region, but the owner of the Esperanza FWSD #1 reports that water levels usually recover quickly after periods of rainfall. Water quality is a problem in the area, as TDS ranges from approximately 1,000 mg/l to as much as 2,500 mg/l. Other dissolved solids in excess of drinking water standards are fluoride and manganese. The possibilities for expansion are limited by the occurrence of saline groundwater in both the Rio Grande Alluvium and the Hueco Bolson Aquifer.

3.2.12.5 Jeff Davis County

Community of Fort Davis – The Fort Davis Water Supply Corporation (FDWSC) provides water to the Community of Fort Davis and the surrounding area from three wells completed in the Igneous Aquifer. One of the wells is used only as a backup. Water levels in the vicinity of the wells have remained stable; and other than elevated fluoride, there are no reported problems with water quality. The FDWSC has recently completed an additional well in town and is considering connecting to a private public-supply well east of town.

Town of Valentine – The Town of Valentine relies on one municipal water supply well completed in the Ryan Flat Aquifer. A pumping test conducted on the well in 2004 produced at an average rate of 59 gpm with 201 feet of water level drawdown. A second well owned by the Valentine Independent School District provides water to the school and to a small number of residences occupied by teachers. Water levels near Valentine have remained stable, and there are no reported problems with water quality. Under consideration is a proposal to drill a second municipal water supply well. The Ryan Flat Aquifer appears to have ample capacity to support additional well development for Valentine.

3.2.12.6 Presidio County

City of Marfa – The City of Marfa depends on three city-owned wells for all its municipal water needs. Two of the wells can produce as much as 1,100 gpm, and the third well yields an additional 450 gpm. The Tertiary volcanic formations of the Igneous Aquifer are the source of groundwater. Other than fluoride, which has been reported at concentrations ranging from 2.5 to 3 mg/l, all other dissolved solids are below their respective safe drinking-water standards, and TDS are typically less than 400 mg/l. The City of Marfa recently drilled a new well to replace an older well that was no longer functioning.

City of Presidio – The City of Presidio derives its municipal water from four wells located east of the City along Alamito Creek. The wells are approximately 530 feet in depth and produce from the Presidio Bolson Aquifer. A water quality analysis of one of the wells records a total dissolved solids level of 374 mg/l. Additional supply is needed to serve a developing area around the airport north of town.

3.2.12.7 Terrell County

Community of Sanderson – The Terrell County WCID#1 provides municipal water to the Community of Sanderson from 14 active public supply wells that produce groundwater from the Edwards-Trinity

(Plateau) Aquifer. The wells are in three fields; four in the north field, three in the middle field, and seven in the south field. Water levels have remained stable; and water quality is not reported to be a problem for the Community.

3.2.13 Groundwater Exports

Jeff Davis is the only county from which water is exported to other areas outside of its borders. As shown by Table 3-8 below, in 2017 the City of Alpine pumped 689 acre-feet from four wells in the Musquiz well field in southeastern Jeff Davis County. All other exports go to Reeves County. In 2017 the City of Balmorhea and the Madera Valley WSC extracted 175 and 83 acre-feet respectively, from the Edwards-Trinity (Plateau) & Pecos Valley Alluvium aquifers in northeastern Jeff Davis County.

Table 3-8. Far West Texas 2017 Groundwater Exports
(Acre Feet per Year)

Exporting County	Receiving County	Received By	Source	Amount in 2017	Remarks
Jeff Davis	Brewster	City of Alpine	Igneous Aquifer	689	Pumpage from four wells in Musquiz wellfield
Jeff Davis	Reeves	City of Balmorhea	Pecos Valley	175	Pumpage from one well
Jeff Davis	Reeves	Madera Valley WSC	Pecos Valley	83	Pumpage from two wells

Source: Jeff Davis County Underground Water Conservation District
Note: See Region F Water Plan for future water use projections for the Reeves County water user entities.

Also, the U.S. Bureau of Reclamation has water rights for diversions of up to 18,936 acre-feet per year of surface water from Phantom Creek for irrigation use in Reeves County.

3.3 LOCAL SUPPLY

Limited surface water supplies, “Local Supplies”, are recognized to occur within “stock tanks” that catch precipitation runoff and are used primarily for livestock watering, but at times may be available for other local needs such as mining and irrigation. For planning purposes, the volume of runoff water in these catchment basins is significantly reduced during drought-of-record conditions and does not include any groundwater that might be pumped into them. No documentation has been identified that quantifies the available supply during drought-of-record conditions for these local supplies. Thus, per TWDB regional water planning guidelines, it is assumed for this 2021 Far West Texas Water Plan that all local supplies not represented by a specified water right have a volume of zero ac-ft per year.

3.4 REUSE

Reuse refers to the utilization of return flows from municipal wastewater treatment plants and other water users. Reuse water can be broadly characterized as one of two types: direct reuse, or wastewater that is reused without first being discharged into a stream or watercourse, and indirect reuse in which wastewater is discharged to a stream or other watercourse prior to being diverted for use.

El Paso Water's direct reuse project involves wastewater treatment from four facilities with a combined treatment capacity of 107,758 acre-feet per year, and has nearly 40 miles of reclaimed water lines (purple pipeline) in place in all areas of the City. Reclaimed water serves the landscape irrigation demand of golf courses, parks, schools, and cemeteries, and provides water supplies for steam electric plants and industries within the City. EPW does not plan on extending or growing the purple pipe infrastructure, but will focus on maintaining existing purple pipe customers and work towards increasing the use of reclaimed water through additional purified water projects (see EPW strategies in Chapter 5). For planning purposes, the direct reuse supply estimated to be available to EPW (Table 3-1) increases from 13,748 in 2020 to 19,836 acre-feet per year in 2070, which is 10 percent of future projected EPW water-supply demand per decade. The current use of treated wastewater as reported by the utility is 6,000 acre-feet per year (Table 3-2).

The City of Alpine in Brewster County is also reusing treated wastewater to irrigate City public spaces. Direct reuse supply available to the City utility (Table 3-1) is 193 acre-feet per year, which is 10 percent of future projected water supply demand. The City reports that it treats an average of 448 acre-feet of wastewater per year and discharges approximately 84 acre-feet per year (Table 3-2).

Indirect reuse in the form of municipal return flow is an important source of supply for irrigators in El Paso and Hudspeth Counties during the irrigation season from March through September. Supplies currently available in El Paso County are estimated be 34,164 acre-feet per year. Irrigators in Hudspeth County utilize irrigation return flows from Rio Grande Project water, which is estimated to total 334 acre-feet per year.

APPENDIX 3A
AUTHORIZED SURFACE WATER RIGHTS

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APPENDIX 3A. AUTHORIZED SURFACE WATER RIGHTS AS EXTRACTED FROM TCEQ'S ACTIVE WATER RIGHTS MASTER FILE

Water Right Number	Water Right Type	Applica-tion Number	Owner	Diversion Amount (ac-ft)	Use	Priority Date	Reservoir Name	Reservoir Capacity (ac-ft)	Site Name	Basin	County
121	App/Perm	121	CLAYTON W WILLIAMS JR ET AL	124	D&L	9/13/1915	RES 1, RES 2	16		Rio Grande	Jeff Davis
375	Cert Filing		US DEPT OF THE INTERIOR	900	Irr	6/25/1914	PHANTOM LAKE		RIO GRANDE PROJECT.BUREAU	Rio Grande	Jeff Davis
899	Cert of Adj		C & L COMPANY	60	Irr	2/12/1925				Rio Grande	Presidio
900	Cert of Adj		DARWIN RAY NILSSON ET AL	800	Irr	1/28/1924		395		Rio Grande	Hudspeth
900	Cert of Adj		DARWIN RAY NILSSON ET AL	700	Irr	1/1/1909				Rio Grande	Hudspeth
901	Cert of Adj		WILLIAM N ROTH ET AL	507	Irr	1/1/1932				Rio Grande	Hudspeth
902	Cert of Adj		GILBERTO MORALES & PATRICIA ROSALES	287.5	Irr	1/1/1925				Rio Grande	Hudspeth
902	Cert of Adj		ESTATE OF SIDNEY W COWAN	42.5	Irr	1/1/1925				Rio Grande	Hudspeth
903	Cert of Adj		DOUGLAS A JOHNSTON	63	Irr	1/1/1925				Rio Grande	Hudspeth
904	Cert of Adj		JIM B BEAN ET AL	831	Irr	1/1/1925				Rio Grande	Hudspeth
905	Cert of Adj		KATHRYNE ALICE G LOPEZ ET AL	330	Irr	1/1/1925				Rio Grande	Hudspeth
906	Cert of Adj		TOM H NEELY TRUST	164	Irr	1/1/1925				Rio Grande	Hudspeth
906	Cert of Adj		RAYMOND R WHETSTONE ET AL	82	Irr	1/1/1925				Rio Grande	Hudspeth
907	Cert of Adj		LOUIS M FOIX SR	150	Irr	1/1/1925				Rio Grande	Hudspeth
908	Cert of Adj		LESTER RAY TALLEY JR ET AL	138	Irr	1/1/1919				Rio Grande	Hudspeth
909	Cert of Adj		LESTER RAY TALLEY JR ET AL	144	Irr	1/1/1947				Rio Grande	Hudspeth
910	Cert of Adj		LESTER RAY TALLEY ET AL	126	Irr	1/1/1948				Rio Grande	Hudspeth
911	Cert of Adj		LESTER RAY TALLEY	216	Irr	1/1/1952				Rio Grande	Hudspeth
912	Cert of Adj		AUTRY C STEPHENS	15	Irr	1/1/1920				Rio Grande	Hudspeth
912	Cert of Adj		AUTRY C STEPHENS	162	Irr	1/1/1948				Rio Grande	Hudspeth
913	Cert of Adj		GLORIA GUERRA ADDINGTON	582	Irr	1/1/1912				Rio Grande	Hudspeth
914	Cert of Adj		TEXAS PARKS & WILDLIFE DEPT	219	Irr	1/1/1939				Rio Grande	Hudspeth
914	Cert of Adj		TEXAS PARKS & WILDLIFE DEPT		Other	1/1/1939				Rio Grande	Hudspeth
915	Cert of Adj		RANCHO PENSADO PROPERTIES LLC	291.6	Irr	1/1/1902				Rio Grande	Presidio
915	Cert of Adj		OSCAR B JACKSON	291.6	Irr	1/1/1902				Rio Grande	Presidio
915	Cert of Adj		RANCHO PENSADO PROPERTIES LLC	291.6	Irr	1/1/1902				Rio Grande	Presidio
915	Cert of Adj		KENNETH R MATHEWS	291.6	Irr	1/1/1902				Rio Grande	Presidio
915	Cert of Adj		HARRY MILLER	291.6	Irr	1/1/1902				Rio Grande	Presidio
915	Cert of Adj		ANDREW H JACKSON	194.4	Irr	1/1/1902				Rio Grande	Presidio
915	Cert of Adj		C B FIELDS	291.6	Irr	1/1/1902				Rio Grande	Presidio
916	Cert of Adj		TEXAS PARKS & WILDLIFE DEPT	714	Irr	1/1/1932			LOS PALOMAS WLMA	Rio Grande	Presidio
917	Cert of Adj		LEO J PAVLAS & CARLYE PAVLAS	405	Irr	11/11/1924				Rio Grande	Presidio
918	Cert of Adj		BILLY O WALKER ET UX	29.19	Irr	1/1/1932				Rio Grande	Presidio
918	Cert of Adj		B J BISHOP	18.81	Irr	1/1/1932				Rio Grande	Presidio
919	Cert of Adj		JAVIER R MOLINA ET UX	243	Irr	1/1/1949				Rio Grande	Presidio
920	Cert of Adj		GORDON LEE JONES ET UX	475.78	Irr	3/20/1917				Rio Grande	Presidio
920	Cert of Adj		FERNWOOD ENTERPRISES	19.22	Irr	3/20/1917				Rio Grande	Presidio
921	Cert of Adj		AC&L ARMENDARIZ PARTNERSHIP	270	Irr	1/1/1917				Rio Grande	Presidio
922	Cert of Adj		MERCED O GARCIA ET AL	90	Irr	1/1/1924				Rio Grande	Presidio
923	Cert of Adj		LA HACIENDITA PECAN COMPANY LLC	120	Irr	3/20/1917				Rio Grande	Presidio
924	Cert of Adj		LA HACIENDITA PECAN COMPANY LLC	54	Irr	3/20/1917				Rio Grande	Presidio
925	Cert of Adj		ERNESTINA CHAVEZ ET AL	42	Irr	3/26/1917				Rio Grande	Presidio
926	Cert of Adj		ROBERT L SOZA	66	Irr	3/26/1917				Rio Grande	Presidio
927	Cert of Adj		LAJITAS CAPITAL PARTNERS LLC	72	Irr	3/26/1917				Rio Grande	Presidio
928	Cert of Adj		LAJITAS CAPITAL PARTNERS LLC	57	Irr	3/26/1917				Rio Grande	Presidio
929	Cert of Adj		ALFREDO S BAEZA	48	Irr	3/26/1917				Rio Grande	Presidio
930	Cert of Adj		SOZA & COMPANY	114	Irr	3/26/1917				Rio Grande	Presidio
931	Cert of Adj		ROBERTO R SPENCER ET AL	111	Irr	3/26/1917				Rio Grande	Presidio
932	Cert of Adj		FRANK ARMENDARIZ ET UX	606	Irr	3/26/1917				Rio Grande	Presidio

APPENDIX 3A. (Continued) AUTHORIZED SURFACE WATER RIGHTS

Water Right Number	Water Right Type	Applica-tion Number	Owner	Diversion Amount (ac-ft)	Use	Priority Date	Reservoir Name	Reservoir Capacity (ac-ft)	Site Name	Basin	County
933	Cert of Adj		LUZ S ARMENDARIZ	321	Irr	3/26/1917				Rio Grande	Presidio
936	Cert of Adj		JOSE N RODRIGUEZ	113.806	Irr	3/26/1917				Rio Grande	Presidio
936	Cert of Adj		JOSE N RODRIGUEZ	33.994	Irr	1/1/1914				Rio Grande	Presidio
936	Cert of Adj		SALVADOR RODRIGUEZ SR	33.166	Irr	1/1/1914				Rio Grande	Presidio
936	Cert of Adj		SALVADOR RODRIGUEZ SR	111.034	Irr	3/26/1917				Rio Grande	Presidio
937	Cert of Adj		JOSE A RODRIGUEZ	114	Irr	3/26/1917				Rio Grande	Presidio
938	Cert of Adj		JOSE A RODRIGUEZ	120	Irr	3/26/1917				Rio Grande	Presidio
939	Cert of Adj		LORENZO HERNANDEZ	45	Irr	3/26/1917				Rio Grande	Presidio
939	Cert of Adj		LORENZO HERNANDEZ	45	Irr	3/26/1917				Rio Grande	Presidio
940	Cert of Adj		JESUS M RODRIGUEZ JR	180	Irr	1/1/1914				Rio Grande	Presidio
941	Cert of Adj		RCS INC	164	Irr	3/26/1917				Rio Grande	Presidio
942	Cert of Adj		PAULINE JUAREZ CROSSON	25.98	Irr	1/1/1914				Rio Grande	Presidio
942	Cert of Adj		RCS INC	145.32	Irr	1/1/1914				Rio Grande	Presidio
942	Cert of Adj		EDMUNDO SANCHEZ	28.7	Irr	1/1/1914				Rio Grande	Presidio
943	Cert of Adj		RCS INC	420	Irr	1/1/1927				Rio Grande	Presidio
944	Cert of Adj		SANTA CRUZ LAND & CATTLE INC	743	Irr	2/12/1925				Rio Grande	Presidio
946	Cert of Adj		RCS INC	61	Irr	2/12/1925				Rio Grande	Presidio
947	Cert of Adj		RCS INC	800	Irr	2/12/1925				Rio Grande	Presidio
948	Cert of Adj		C & L COMPANY	880	Irr	2/12/1925				Rio Grande	Presidio
949	Cert of Adj		C & L COMPANY	267	Irr	12/12/1924				Rio Grande	Presidio
950	Cert of Adj		OSCAR M SPENCER	39	Irr	2/12/1925				Rio Grande	Presidio
952	Cert of Adj		CITY OF EAGLE PASS WATER WORKS SYSTEM	4600	Mun	2/12/1925				Rio Grande	Presidio
952	Cert of Adj		CITY OF LAREDO	2818	Mun	2/12/1925				Rio Grande	Presidio
952	Cert of Adj		MAVERICK COUNTY	641	Mun	2/12/1925				Rio Grande	Presidio
953	Cert of Adj		CF&L ENTERPRISES	407	Irr	2/12/1925				Rio Grande	Presidio
954	Cert of Adj		CF&L ENTERPRISES	684	Irr	2/12/1925				Rio Grande	Presidio
955	Cert of Adj		CF&L ENTERPRISES	172	Irr	2/12/1925				Rio Grande	Presidio
956	Cert of Adj		MANUEL M RUBIO ET AL	84	Irr	1/1/1925				Rio Grande	Presidio
957	Cert of Adj		EVA MARIA NIETO ET AL	536	Irr	1/1/1932				Rio Grande	Presidio
958	Cert of Adj		OSCAR CARNERO	48.28	Irr	1/1/1932				Rio Grande	Presidio
958	Cert of Adj		MANUEL COVOS ET UX	43.72	Irr	1/1/1932				Rio Grande	Presidio
960	Cert of Adj		LAURENCIO BRITO	140	Irr	1/1/1932				Rio Grande	Presidio
961	Cert of Adj		LAURENCIO BRITO	72	Irr	1/1/1925				Rio Grande	Presidio
962	Cert of Adj		REYNALDO HERNANDEZ	96	Irr	1/1/1925				Rio Grande	Presidio
963	Cert of Adj		RCS INC	160	Irr	1/1/1900				Rio Grande	Presidio
964	Cert of Adj		RCS INC	376	Irr	1/1/1927				Rio Grande	Presidio
965	Cert of Adj		GEORGE & CONSUELO HERNANDEZ	60	Irr	1/1/1900				Rio Grande	Presidio
966	Cert of Adj		HECTOR A HERNANDEZ	80	Irr	1/1/1918				Rio Grande	Presidio
967	Cert of Adj		HERMINIA M MCCALL	80	Irr	1/1/1932				Rio Grande	Presidio
967	Cert of Adj		HERMINIA M MCCALL ET AL	180	Irr	1/1/1932				Rio Grande	Presidio
969	Cert of Adj		JOHN T MACGUIRE ET UX		Rec	10/13/1910	SAN ESTEBAN DAM & LAKE	1870		Rio Grande	Presidio
971	Cert of Adj		WILLIAM M WEATHERS ET UX	35	Irr	1/1/1918				Rio Grande	Presidio
972	Cert of Adj		LUCIA H RUSSELL ESTATE	80	Irr	10/13/1927				Rio Grande	Presidio
973	Cert of Adj		JOSE A HERNANDEZ	96	Irr	1/1/1948				Rio Grande	Presidio
974	Cert of Adj		PRESIDIO CO WID 1	2780	Irr	1/1/1978				Rio Grande	Presidio
975	Cert of Adj		LAJITAS CAPITAL PARTNERS LLC	380	Irr	1/1/1908				Rio Grande	Presidio
976	Cert of Adj		RUBEN H MADRID	56	Irr	1/1/1952				Rio Grande	Presidio
977	Cert of Adj		LYDIA MADRID	40	Irr	1/1/1945				Rio Grande	Presidio
978	Cert of Adj		MARGARITA C MADRID ET AL	32	Irr	1/1/1953				Rio Grande	Presidio
978	Cert of Adj		MARGARITA C MADRID ET AL	304	Irr	8/12/1974				Rio Grande	Presidio
979	Cert of Adj		JOSEPH TRAVIS TUCKER JR	52	Irr	1/1/1953				Rio Grande	Presidio

APPENDIX 3A. (Continued) AUTHORIZED SURFACE WATER RIGHTS

Water Right Number	Water Right Type	Applica-tion Number	Owner	Diversion Amount (ac-ft)	Use	Priority Date	Reservoir Name	Reservoir Capacity (ac-ft)	Site Name	Basin	County
980	Cert of Adj		JOSEPH TRAVIS TUCKER JR	52	Irr	1/1/1953				Rio Grande	Presidio
981	Cert of Adj		NADINE PINEDA MATA	84	Irr	1/1/1921				Rio Grande	Presidio
981	Cert of Adj		LEO N PINEDA	84	Irr	1/1/1921				Rio Grande	Presidio
982	Cert of Adj		JAIME REDE MADRID ET AL	80	Irr	1/1/1947				Rio Grande	Presidio
983	Cert of Adj		THOMAS A MALLAN	84	Irr	1/1/1947				Rio Grande	Presidio
985	Cert of Adj		ADAN MADRID & NINFA MADRID	20	Irr	1/1/1921				Rio Grande	Presidio
986	Cert of Adj		LAJITAS CAPITAL PARTNERS LLC	224.26	Irr	3/26/1917				Rio Grande	Brewster
986	Cert of Adj		LAJITAS MUNICIPAL SERVICES CO LLC	144	Mun	3/26/1917				Rio Grande	Brewster
986	Cert of Adj		FRANK W HOWARD	0.74	Irr	3/26/1917				Rio Grande	Brewster
987	Cert of Adj		US NATIONAL PARK SVC/US DEPT OF	530	Mun	11/17/1915			BIG BEND NATIONAL PARK.US	Rio Grande	Brewster
987	Cert of Adj		US NATIONAL PARK SVC/US DEPT OF	1000	Irr	11/17/1915			U S DEPT OF THE INTERIOR	Rio Grande	Brewster
988	Cert of Adj		EL CARMEN LAND & CONSERVATION CO LLC	20	Irr	1/1/1932				Rio Grande	Brewster
989	Cert of Adj		EL CARMEN LAND & CONSERVATION CO LLC	180	Irr	1/1/1932				Rio Grande	Brewster
990	Cert of Adj		SUSAN COMBS ET AL	1520	Irr	7/2/1925			COMBS MARAVILLAS RANCHES	Rio Grande	Brewster
991	Cert of Adj		W N CHRIS JORDAN	3800	Irr	7/2/1925				Rio Grande	Brewster
991	Cert of Adj		E A BASSE III	3800	Irr	7/2/1925				Rio Grande	Brewster
992	Cert of Adj		BYRON HODGE ET AL	152	Irr	1/1/1956				Rio Grande	Terrell
1172	Cert of Adj		SCOTT LOCKE MCIVOR	15	Irr	4/1/1963		20		Rio Grande	Jeff Davis
1172	Cert of Adj		SCOTT LOCKE MCIVOR		Rec	4/1/1963				Rio Grande	Jeff Davis
1173	Cert of Adj		TANNER FULTON WHITESELL	13.8	Irr	1/1/1923				Rio Grande	Jeff Davis
1173	Cert of Adj		TRENT MCCANN WHITESELL	13.8	Irr	1/1/1923				Rio Grande	Jeff Davis
1173	Cert of Adj		STEPHANIE SPROUL RENTFRO	13.8	Irr	1/1/1923				Rio Grande	Jeff Davis
1173	Cert of Adj		JOHNATHAN MCCANN RENTFRO	13.8	Irr	1/1/1923				Rio Grande	Jeff Davis
1173	Cert of Adj		ZACHARY EVERETT RENTFRO	13.8	Irr	1/1/1923				Rio Grande	Jeff Davis
1174	Cert of Adj		H E SPROUL	224	Irr	1/1/1992		3		Rio Grande	Jeff Davis
1174	Cert of Adj		H E SPROUL		Rec	1/1/1992				Rio Grande	Jeff Davis
1175	Cert of Adj		ISABEL CECILIA THOMPSON	5	Irr	1/1/1916				Rio Grande	Jeff Davis
1176	Cert of Adj		JIMMY G & BESSIE J HIGGINS	4	Irr	1/1/1985				Rio Grande	Jeff Davis
1177	Cert of Adj		GEORGE A HOFFMAN MD ET AL	50	Irr	11/4/1907				Rio Grande	Jeff Davis
1178	Cert of Adj		ESTELLE LANGHAM SHARP	15	Irr	1/1/3796				Rio Grande	Jeff Davis
1392	App/Perm	149	U S BUREAU OF RECLAM	18000	Irr	6/18/1946			BUREAU OF RECLAMATION	Rio Grande	Jeff Davis
2926	Claim		LEONCITA LAND COMPANY		Irr	8/28/1969		900		Rio Grande	Brewster
3002	App/Perm	324	JOE RUSSELL BROWN	312	Irr	6/15/1974				Rio Grande	Hudspeth
3003	App/Perm	324	JOE RUSSELL BROWN	156	Irr	7/15/1974				Rio Grande	Hudspeth
3005	App/Perm	325	THOMAS E HAEFELI ET AL	108	Irr	8/12/1974				Rio Grande	Presidio
3006	App/Perm	325	LAJITAS RESORT LTD	132	Irr	8/12/1974				Rio Grande	Presidio
3032	App/Perm	329	POPE RANCH	140.7	Irr	11/4/1974				Rio Grande	Brewster
3032	App/Perm	329	POPE RANCHES LP	1119.3	Irr	11/4/1974				Rio Grande	Brewster
3033	App/Perm	332	SUSAN COMBS ET AL	80	Irr	12/16/1974	SUMP HOLE AT THE CONFLUENCE OF	10	COMBS MARAVILLAS RANCHES	Rio Grande	Brewster
3033	App/Perm	332	SUSAN COMBS ET AL	20	Rec	12/16/1974			COMBS MARAVILLAS RANCHES	Rio Grande	Brewster
3033	App/Perm	332	SUSAN COMBS ET AL		Irr	12/16/1974			COMBS MARAVILLAS RANCHES	Rio Grande	Brewster
3034	App/Perm	332	SUSAN COMBS ET AL	450	Irr	12/16/1974			COMBS MARAVILLAS RANCHES	Rio Grande	Brewster
3041	App/Perm	331	TEXAS PARKS & WILDLIFE DEPT	1017	Irr	12/9/1974				Rio Grande	Hudspeth
3041	App/Perm	331	TEXAS PARKS & WILDLIFE DEPT		Other	12/9/1974				Rio Grande	Hudspeth
3092	App/Perm	339	LUCIA H RUSSELL ESTATE	100	Irr	1/12/1970				Rio Grande	Presidio
3112	App/Perm	339	TEXAS PARKS & WILDLIFE DEPT	156	Irr	2/10/1975				Rio Grande	Presidio
3113	App/Perm	340	WALTER TRAVIS POTTER	200	Irr	2/24/1975				Rio Grande	Brewster
3133	App/Perm	336	NEVILLE RANCH	18	Irr	6/24/1975				Rio Grande	Brewster
3133	App/Perm	336	ELINOR FRANCES GREEN	162	Irr	1/20/1975		9		Rio Grande	Brewster
3144	App/Perm	340	JACKSON B LOVE JR	400	Irr	3/3/1975				Rio Grande	Brewster
3153	App/Perm	340	J FRANK WOODWARD JR	12.5	Irr	3/3/1975				Rio Grande	Brewster

APPENDIX 3A. (Continued) AUTHORIZED SURFACE WATER RIGHTS

Water Right Number	Water Right Type	Application Number	Owner	Diversion Amount (ac-ft)	Use	Priority Date	Reservoir Name	Reservoir Capacity (ac-ft)	Site Name	Basin	County
5375	App/Perm	5375	BREWSTER COUNTY		Rec	8/16/1991		7		Rio Grande	Brewster
5439	Cert of Adj		CITY OF BALMORHEA	644	Mun	1/29/1930		109		Rio Grande	Jeff Davis
5440	Cert of Adj		JAMES P ESPY JR ET AL	45	Irr	12/31/1939	2 1-AF RESERVOIRS	2		Rio Grande	Jeff Davis
5451	Cert of Adj		MISSOURI PACIFIC RAILROAD		Stor	6/16/1914	LEVINSON RES	597		Rio Grande	Jeff Davis
5451	Cert of Adj		MISSOURI PACIFIC RAILROAD		Stor	7/25/1960	LEVINSON RES	327		Rio Grande	Jeff Davis
5451	Cert of Adj		J L DAVIS	223	Irr	7/25/1960				Rio Grande	Jeff Davis
5452	Cert of Adj		BARRY A BEAL	50	Irr	11/13/1915		2		Rio Grande	Jeff Davis
5462	Cert of Adj		ESTATE OF JOE B CHANDLER ET AL	125.09	Irr	2/17/1920	2 RES; 8 AF & 6 AF	14		Rio Grande	Terrell
5462	Cert of Adj		JOBETH ELROD & CHARLENA J CHANDLER	10.72	Irr	2/17/1920				Rio Grande	Terrell
5462	Cert of Adj		THE NATURE CONSERVANCY	4.19	Irr	2/17/1920				Rio Grande	Terrell
5463	Cert of Adj		THE NATURE CONSERVANCY	530	Irr	12/31/1900	3 RESERVOIRS	192		Rio Grande	Terrell
5464	Cert of Adj		WILSON HARDIN "CY" BANNER	150	Irr	12/31/1919				Rio Grande	Terrell
5465	Cert of Adj		JOHN EDWARD ROBBINS	8.25	Irr	7/12/1919				Rio Grande	Terrell
5465	Cert of Adj		JOHN CLARK		Irr	7/12/1919				Rio Grande	Terrell
5466	Cert of Adj		WILSON HARDIN "CY" BANNER	44.4	Irr	12/31/1917		15		Rio Grande	Terrell
5466	Cert of Adj		MATTIE BANNER BELL	0.6	Irr	12/31/1917				Rio Grande	Terrell
5467	Cert of Adj		C L RANCH PARTNERSHIP	2200	Irr	9/15/1980		775		Rio Grande	Hudspeth
5467	Cert of Adj		CONNECTICUT MUTUAL LIFE INS CO		Irr	9/15/1980				Rio Grande	Hudspeth
5467	Cert of Adj		JAMES & MARY LYNCH JR		Irr	9/15/1980				Rio Grande	Hudspeth
5468	Cert of Adj		C L MACHINERY CO ET AL	2400	Irr	9/15/1980		458		Rio Grande	Hudspeth
5468	Cert of Adj		CONNECTICUT MUTUAL LIFE INS CO		Irr	9/15/1980				Rio Grande	Hudspeth
5469	Cert of Adj		C L RANCH PARTNERSHIP	2100	Irr	9/15/1980		588		Rio Grande	Hudspeth
5940	Cert of Adj		UNITED STATES OF AMERICA	376000[1]	Mun	7/6/1899	ELEPHANT BUTTE RES & CABALLO RES	26388	MESILLA, AMERICAN, RIVERSIDE	Rio Grande	El Paso
5940	Cert of Adj		UNITED STATES OF AMERICA		Ind	7/6/1899	ELEPHANT BUTTE RES & CABALLO RES		MESILLA, AMERICAN, RIVERSIDE	Rio Grande	El Paso
5940	Cert of Adj		UNITED STATES OF AMERICA		Irr	7/6/1899	ELEPHANT BUTTE RES & CABALLO RES		MESILLA, AMERICAN, RIVERSIDE	Rio Grande	El Paso
5940	Cert of Adj		UNITED STATES OF AMERICA		Min	7/6/1899	ELEPHANT BUTTE RES & CABALLO RES		MESILLA, AMERICAN, RIVERSIDE	Rio Grande	El Paso
5940	Cert of Adj		UNITED STATES OF AMERICA		Rec	7/6/1899	ELEPHANT BUTTE RES & CABALLO RES		MESILLA, AMERICAN, RIVERSIDE	Rio Grande	El Paso
5940	Cert of Adj		EL PASO CO WID 1		Mun	7/6/1899	ELEPHANT BUTTE RES & CABALLO RES		MESILLA, AMERICAN, RIVERSIDE	Rio Grande	El Paso
5940	Cert of Adj		EL PASO CO WID 1		Ind	7/6/1899	ELEPHANT BUTTE RES & CABALLO RES		MESILLA, AMERICAN, RIVERSIDE	Rio Grande	El Paso
5940	Cert of Adj		EL PASO CO WID 1		Irr	7/6/1899	ELEPHANT BUTTE RES & CABALLO RES		MESILLA, AMERICAN, RIVERSIDE	Rio Grande	El Paso
5940	Cert of Adj		EL PASO CO WID 1		Min	7/6/1899	ELEPHANT BUTTE RES & CABALLO RES		MESILLA, AMERICAN, RIVERSIDE	Rio Grande	El Paso
5940	Cert of Adj		EL PASO CO WID 1		Rec	7/6/1899	ELEPHANT BUTTE RES & CABALLO RES		MESILLA, AMERICAN, RIVERSIDE	Rio Grande	El Paso
5941	Cert of Adj		CEMEX EL PASO INC	178	Ind	1/1/1910	CEMENT LAKE	178		Rio Grande	El Paso
5942	Cert of Adj		CITY OF EL PASO	11000	Mun	11/1/1948				Rio Grande	El Paso
5943	Cert of Adj		INDIAN CLIFFS RANCH INC		Rec	10/11/1977		52		Rio Grande	El Paso
5944	Cert of Adj		UNITED STATES OF AMERICA	27,000[2]	Irr	11/22/1917				Rio Grande	El Paso
5944	Cert of Adj		HUDSPETH COUNTY CRD 1		Irr	11/22/1917				Rio Grande	El Paso
5944	Cert of Adj		HUDSPETH COUNTY CRD 1		Ind	11/22/1917				Rio Grande	El Paso
5944	Cert of Adj		HUDSPETH COUNTY CRD 1		Min	11/22/1917				Rio Grande	El Paso
5944	Cert of Adj		HUDSPETH COUNTY CRD 1		Rec	11/22/1917				Rio Grande	El Paso

1. TCEQ indicated that CA 5940 has an authorization for water in addition to the 376,000 acre-feet of project water in the amount of 1,899 acre-feet per year that is not reflected in the Active Water Rights Master File.
2. TCEQ's Active Water Rights Master File says permitted diversion of CA 5944 is 26,600 ac-ft/yr but TCEQ confirmed that the value in the WAM, 27,000 ac-ft/yr, is correct.

CHAPTER 4
IDENTIFICATION OF WATER NEEDS

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4 IDENTIFICATION OF WATER NEEDS

Chapter 4 provides projections (Table 4-1) of water supply surpluses or deficits for all water user groups (WUGs) by decade based on a comparison of projected water demands by decade for each water-use entity from Chapter 2 (Table 2-2) with water supplies available to meet those demands from Chapter 3 (Table 3-2). A water supply deficit may develop for individual water-use entities for numerous reasons including supply availability limits, infrastructure limitations, or legal limits. Major Water Provider needs by water-use category are provided in Table 4-2. Similarly, Table 4-3provide the needs/surpluses analysis for all Major Water Providers and by category of use.

Water supply deficits are identified for several municipalities, manufacturing use and steam power electric generation in El Paso County; for irrigation supply use in Culberson and El Paso Counties, and for mining supply in El Paso, Hudspeth and Terrell Counties.

A secondary water needs analysis by all water user groups and by category of use for which conservation or direct reuse water management strategies are recommended is provided in Table 4-5 and 4-6. This secondary water needs analysis calculates the water needs that would remain after assuming all recommended conservation and reuse water management strategies are fully implemented. Tables 4-7 provides similar data by Major Water Providers.

Water supply strategy recommendations are then made in Chapter 5 for those water users that have projected water supply deficits based on the comparison between demand and supply. In addition, strategies are also developed for specific entities that although they are not projected to have future shortages, they do have anticipated water-supply projects that deserve to be recognized in the *Regional Plan.* A socioeconomic impact of unmet water needs analysis prepared by the Texas Water Development Board is provided in Chapter 6, Appendix 6A.

Table 4-1. Identified Water (Needs)/Surpluses
(Acre Feet per Year)

	2020	2030	2040	2050	2060	2070
Brewster County						
Alpine	622	612	621	623	619	616
Lajitas Municipal Services	228	227	228	228	227	227
Marathon Water Supply	118	116	116	115	115	115
County-Other	275	255	253	250	247	244
Livestock	19	19	19	19	19	19
Irrigation	1,381	1,381	1,381	1,381	1,381	1,381
Brewster County Total Needs/Surplus	2,643	2,610	2,618	2,616	2,608	2,602
Culberson County						
Van Horn	354	305	279	256	242	233
County-Other	92	88	86	84	83	82
Manufacturing	1	0	0	0	0	0
Mining	1,926	1,192	1,039	1,322	1,589	1,792
Livestock	15	15	15	15	15	15
Irrigation	(333)	(333)	(5,858)	(5,858)	(5,858)	(5,858)
Culberson County Total Needs/Surplus	2,055	1,267	1,086	1,344	1,596	1,789
El Paso County						
Anthony	762	627	499	369	241	120
East Biggs Water System	444	444	444	444	444	444
East Montana Water System	435	350	267	177	86	0
El Paso County Tornillo WID	487	495	501	504	504	503
El Paso WCID #4	1,045	1,062	1,074	1,072	1,057	1,039
El Paso Water	20,428	10,685	1,287	(8,978)	(19,601)	(29,792)
Federal Correctional Institution La Tuna	1,664	1,671	1,674	1,676	1,677	1,677
Fort Bliss Water Services	2,277	2,237	2,134	1,976	1,827	1,677
Haciendas Del Norte WID	110	88	66	44	21	0
Horizon Regional MUD	(2,709)	(5,816)	(8,735)	(11,641)	(14,403)	(17,008)
Lower Valley Water District	(1,358)	(2,207)	(3,042)	(3,934)	(4,833)	(5,689)
Paseo Del Este MUD 1	575	462	351	232	114	0
County-Other | Vinton Hills Estates	56	35	16	(4)	(24)	(42)
County-Other | Vinton Hills Subdivision	131	83	38	(10)	(54)	(96)
County-Other	4,192	3,520	2,883	2,223	1,598	1,006
Manufacturing	269	(860)	(860)	(860)	(860)	(860)
Mining	(1,851)	(2,469)	(3,105)	3,791	(4,536)	(5,382)
Steam Electric Power	(7,260)	(7,260)	(7,260)	(7,260)	(7,260)	(7,260)
Livestock	67	67	67	67	67	67
Irrigation	(46,404)	(46,404)	(46,404)	(46,404)	(46,404)	(46,404)
El Paso County Total Needs/Surplus	(26,640)	(43,190)	(58,105)	(74,098)	(90,339)	(106,000)
Hudspeth County						
Esperanza Water Service	342	332	331	330	329	328
Hudspeth County WCID 1	390	381	380	379	378	377
County-Other | Dell City	18	16	16	16	16	16
County-Other | Fort Hancock WCID	156	151	151	151	150	149
County-Other	(35)	(38)	(38)	(38)	(38)	(39)
Mining	(196)	(168)	(185)	(200)	(209)	(219)
Livestock	23	23	23	23	23	23
Irrigation	10,412	10,412	10,412	10,412	10,412	10,412
Hudspeth County Total Needs/Surplus	1,114	11,109	11,090	11,073	11,061	11,047

Table 4-1. (continued) Identified Water (Needs)/Surpluses
(Acre Feet per Year)

Jeff Davis County						
Fort Davis	149	154	159	161	161	161
County-Other | City of Valentine	0	1	1	2	2	2
County-Other	191	195	198	200	200	200
Mining	0	0	0	0	0	0
Livestock	73	73	73	73	73	73
Irrigation	701	701	701	701	701	701
Jeff Davis County Total Needs/Surplus	1,114	1,124	1,132	1,137	1,137	1,137
Presidio County						
Marfa	1,407	1,362	1,316	1,256	1,202	1,150
Presidio	3,028	2,994	2,958	2,910	2,861	2,813
County-Other	382	370	359	343	329	316
Mining	0	403	403	403	403	403
Livestock	38	38	38	38	38	38
Irrigation	4,995	4,995	4,995	4,995	4,995	4,995
Presidio County Total Needs/Surplus	9,850	10,162	10,069	9,945	9,828	9,715
Terrell County						
Terrell County WCID 1	298	298	298	299	299	299
County-Other	54	54	55	55	55	55
Mining	(483)	(586)	(550)	(416)	(293)	(195)
Livestock	55	55	55	55	55	55
Irrigation	163	163	163	163	163	163
Terrell County Total Needs/Surplus	87	(16)	21	156	279	377
Region E Total Needs/Surplus	**219**	**(16,934)**	**(37,614)**	**(53,352)**	**(69,355)**	**(84,858)**

Note: ( ) Indicates an identified water need.

Table 4-2. Identified Water (Needs)/Surpluses by Category of Use

WUG County	WUG Category	2020	2030	2040	2050	2060	2070
Brewster	Municipal	1,243	1,210	1,218	1,216	1,208	1,202
	Irrigation	1,381	1,381	1,381	1,381	1,381	1,381
	Livestock	19	19	19	19	19	19
Culberson	Municipal	446	393	365	340	325	315
	Irrigation	(333)	(333)	(5,858)	(5,858)	(5,858)	(5,858)
	Livestock	15	15	15	15	15	15
	Manufacturing	1	0	0	0	0	0
	Mining	1,926	1,192	1,039	1,322	1,589	1,792
El Paso	Municipal	28,539	13,736	(543)	(15,850)	(31,346)	(46,161)
	Irrigation	(46,404)	(46,404)	(46,404)	(46,404)	(46,404)	(46,404)
	Livestock	67	67	67	67	67	67
	Manufacturing	269	(860)	(860)	(860)	(860)	(860)
	Mining	(1,851)	(2,469)	(3,105)	(3,791)	(4,536)	(5,382)
	SEP	(7,260)	(7,260)	(7,260)	(7,260)	(7,260)	(7,260)
Hudspeth	Municipal	871	842	840	838	835	831
	Irrigation	10,412	10,412	10,412	10,412	10,412	10,412
	Livestock	23	23	23	23	23	23
	Mining	-196	-168	-185	-200	-209	-219
Jeff Davis	Municipal	340	350	358	363	363	363
	Irrigation	701	701	701	701	701	701
	Livestock	73	73	73	73	73	73
	Mining	0	0	0	0	0	0
Presidio	Municipal	4,817	4,726	4,633	4,509	4,392	4,279
	Irrigation	4,995	4,995	4,995	4,995	4,995	4,995
	Livestock	38	38	38	38	38	38
	Mining	0	403	403	403	403	403
Terrell	Municipal	352	352	353	354	354	354
	Irrigation	163	163	163	163	163	163
	Livestock	55	55	55	55	55	55
	Mining	(483)	(586)	(550)	(416)	(293)	(195)

Table 4-3. Major Water Provider (Needs)/Surpluses (Acre-Feet per Year)

Major Water Provider		2020	2030	2040	2050	2060	2070
El Paso County WID#1	Total Supply	103,166	103,166	103,166	103,166	103,166	103,166
	Total Demand	149,570	149,570	149,570	149,570	149,570	149,570
	Surplus / (Need)	**(46,404)**	**(46,404)**	**(46,404)**	**(46,404)**	**(46,404))**	**(46,404))**
El Paso Water	Total Supply	131,000	131,000	131,000	131,000	131,000	131,000
	Total Demand	137,479	150,245	161,496	173,735	186,304	198,364
	Surplus / (Need)	**(6,479)**	**(19,245)**	**(30,497)**	**(42,735)**	**(55,304)**	**(67,364)**
Lower Valley Water District	Total Supply	4,356	4,356	4,356	4,356	4,356	4,356
	Total Demand	5,714	6,563	7,398	8,290	9,189	10,045
	Surplus / (Need)	**(2,486)**	**(3,528)**	**(4,530)**	**(5,610)**	**(6,713)**	**(7,766)**
Horizon MUD	Total Supply	5,227	5,227	5,227	5,227	5,227	5,227
	Total Demand	7,936	11,043	13,962	16,868	19,630	22,235
	Surplus / (Need)	**(2,709)**	**(5,816)**	**(8,735)**	**(11,641)**	**(14,403)**	**(17,008)**

Table 4-4. Major Water Provider Needs by Category of Use (Acre Feet per Year)

MWP Use Category	2020	2030	2040	2050	2060	2070
Municipal	4,067	8,023	11,777	24,553	38,837	52,489
Irrigation	46,404	46,404	46,404	46,404	46,404	46,404

Table 4-5. Second-Tier Identified Water Needs
(Acre Feet per Year)

	2020	2030	2040	2050	2060	2070
Brewster County						
Rio Grande Basin						
Alpine	0	0	0	0	0	0
Lajitas Municipal Services	0	0	0	0	0	0
Marathon WSSS	0	0	0	0	0	0
County-Other	0	0	0	0	0	0
Livestock	0	0	0	0	0	0
Irrigation	0	0	0	0	0	0
Culberson County						
Rio Grande Basin						
Van Horn	0	0	0	0	0	0
County-Other	0	0	0	0	0	0
Manufacturing	0	0	0	0	0	0
Mining	0	0	0	0	0	0
Livestock	0	0	0	0	0	0
Irrigation	226	226	5,751	5,751	5,751	5,751
El Paso County						
Rio Grande Basin						
Anthony	0	0	0	0	0	0
East Biggs WS	0	0	0	0	0	0
East Montana WS	0	0	0	0	0	0
El Paso County Tornillo WID	0	0	0	0	0	0
El Paso WCID #4	0	0	0	0	0	0
El Paso Water	0	0	0	0	0	1,372
Federal Correctional Institution La Tuna	0	0	0	0	0	0
Fort Bliss Water Services	0	0	0	0	0	0
Haciendas Del Norte WID	0	0	0	0	0	0
Horizon Regional MUD	2433	5,432	8,249	11,054	13,720	16,235
Lower Valley WD	1,301	2,141	2,968	3,851	4,741	5,589
Paseo Del Este MUD 1	0	0	0	0	0	0
County-Other	0	0	0	0	0	0
County-Other | Vinton Hills Estates	0	0	0	3	23	41
County-Other | Vinton Hills Subdivision	0	0	0	7	50	92
Manufacturing	0	860	860	860	860	860
Mining	1,851	2,469	3,105	3,791	4,536	5,382
Steam Electric Power	7,260	7,260	7,260	7,260	7,260	7,260
Livestock	0	0	0	0	0	0
Irrigation	17,941	17,941	17,941	17,941	17,941	17,941

Table 4-5. (Continued) Second-Tier Identified Water Needs
(Acre Feet per Year)

	2020	2030	2040	2050	2060	2070
Hudspeth County						
Rio Grande Basin						
Esperanza Water Service	0	0	0	0	0	0
Hudspeth County WCID #1	0	0	0	0	0	0
County-Other	34	36	36	36	36	37
County-Other | Dell City	0	0	0	0	0	0
County-Other | Fort Hancock WCID	0	0	0	0	0	0
Mining	196	168	185	200	209	219
Livestock	0	0	0	0	0	0
Irrigation	0	0	0	0	0	0
Jeff Davis County						
Rio Grande Basin						
Fort Davis WSC	0	0	0	0	0	0
County-Other	0	0	0	0	0	0
County-Other | City of Valentine	0	0	0	0	0	0
Mining	0	0	0	0	0	0
Livestock	0	0	0	0	0	0
Irrigation	0	0	0	0	0	0
Presidio County						
Rio Grande Basin						
Marfa	0	0	0	0	0	0
Presidio	0	0	0	0	0	0
County-Other	0	0	0	0	0	0
Mining	0	0	0	0	0	0
Livestock	0	0	0	0	0	0
Irrigation	0	0	0	0	0	0
Terrell County						
Rio Grande Basin						
Terrell County WCID #1	0	0	0	0	0	0
County-Other	0	0	0	0	0	0
Mining	483	586	550	416	293	195
Livestock	0	0	0	0	0	0
Irrigation	0	0	0	0	0	0

Table 4-6. Second-Tier Identified Water Needs by Category of Use
(Acre Feet per Year)

Water User Group Category	2020	2030	2040	2050	2060	2070
Municipal	3,734	7,573	11,217	14,905	18,461	23,196
County-Other	34	36	36	46	109	170
Manufacturing	0	860	860	860	860	860
Mining	2,530	3,223	3,840	4,407	5,038	5,796
Steam Electric Power	7,260	7,260	7,260	7,260	7,260	7,260
Livestock	0	0	0	0	0	0
Irrigation	18,167	18,167	23,692	23,692	23,692	23,692

Table 4-7. Second-Tier Identified Water Needs by Major Water Provider
(Acre Feet per Year)

Major Water Provider	2020	2030	2040	2050	2060	2070
El Paso County WID#1	17,941	17,941	17,941	17,941	17,941	17,941
El Paso Water	0	0	0	0	0	1,372
Lower Valley Water District	1,301	2,141	2,968	3,851	4,741	5,589
Horizon MUD	2,433	5,432	8,249	11,054	13,720	16,235

CHAPTER 5

WATER MANAGEMENT STRATEGIES AND CONSERVATION RECOMMENDATIONS

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5 WATER MANAGEMENT STRATEGIES AND CONSERVATION RECOMMENDATIONS

A water management strategy is a plan to meet an identified water need for additional water by an entity, which can mean increasing the total water supply or maximizing an existing supply, including through reducing demand. When a water management strategy project is implemented, it is intended to develop, deliver, and/or treat additional water supply volumes, or conserve water for an entity (TWDB-Exhibit C General Guidelines-April 2018).

The Far West Texas Water Planning Group (FWTWPG) has identified and evaluated a total of 65 water management strategies. Of this total, 48 strategies are recommended and 10 are designated as alternate strategies. Water management strategies are developed for entities where future water supply needs exist (as required by statute and administrative rules 31 TAC §357.34; 357.35). A need for water is identified when existing water supplies are less than projected water demands for that same water user group (WUG) within any planning decade. In addition, water management strategies were developed for other entities requesting specific water supply projects, even though these entities did not have a projected water supply shortage. All planning analyses applied, and recommendations made in the development of this *Plan* honor all existing water rights, contracts, and option agreements; and have no impact on navigation on any of the Region's surface water streams and rivers.

5.1 IDENTIFICATION OF POTENTIALLY FEASIBLE WATER MANAGEMENT STRATAGIES

The first step in developing a list of recommended water management strategies is to take a “big picture” look at possible projects that could reasonably be expected to result in water-supply improvements. As required by TWC §16.053(d)(5) and TAC §357.34(c) the regional water plan shall consider, but not be limited to, the following potentially feasible water management strategies:

1. Conservation
2. Drought management
3. Reuse
4. Management of existing water supplies
5. Conjunctive use
6. Acquisition of available existing water supplies
7. Development of new water supplies
8. Developing regional water supply facilities or providing regional management of water supply facilities
9. Developing large-scale desalination facilities for seawater or brackish groundwater that serve local or regional brackish groundwater production zones identified and designated under TWC §16.060(b)(5)34
10. Developing large-scale desalination facilities for marine seawater that serve local or regional entities
11. Voluntary transfer of water within the region using, but not limited to, contracts, water marketing, regional water banks, sales, leases, options, subordination agreements, and financing agreements
12. Emergency transfer of water under TWC §11.139
13. Interbasin transfers of surface water
14. System optimization
15. Reallocation of reservoir storage to new uses
16. Enhancements of yields
17. Improvements to water quality
18. New surface water supply
19. New groundwater supply
20. Brush control
21. Precipitation enhancement
22. Aquifer storage and recovery
23. Cancellation of water rights
24. Rainwater harvesting

Other potential projects considered for the initial list included:

- appropriate strategies from the *2016 Plan*
- water-loss audits and line replacement
- projects suggested by municipalities through a survey
- projects that are currently or have recently applied to the TWDB for funding

The following process was used by the FWTWPG to identify *potentially feasible water management strategies*.

1. Receive a *Needs Analysis Report* from the TWDB, which provides a comparison of existing water supplies and projected water demands for each water user group (WUG) and wholesale water provider (WWP) in the region. Based on this comparison, the report identifies WUGs and WWPs that are expected to experience needs for additional water supplies within the 50-year time frame of the regional water plan. Using the following process, identify and select potentially feasible water management strategies for each of these entities.
2. Review and consider recommended water management strategies adopted by the water planning group for the *2016 Far West Texas Water Plan*.
3. Review and consider any issues identified in the most current TWDB Water Loss Audit Report, including leak detection and supply side analysis.
4. Solicit current water planning information, including specific water management strategies of interest from WUGs and WWPs with identified needs.
5. Review and consider the most recent Water Supply Management, Water Conservation, and/or Drought Contingency Plans, where available, from WUGs and WWPs with identified needs.
6. Consider potentially feasible water management strategies that may include, but are not limited to (Chapter 357 Subchapter C §357.34):
    - Extended use of existing supplies including:
        a. System optimization and conjunctive use of water resources
        b. Reallocation of reservoir storage to new uses
        c. Voluntary redistribution of water resources including contracts, water marketing, regional water banks, sales, leases, options, subordination agreements, and financing agreements
        d. Subordination of existing water rights through voluntary agreements
        e. Enhancement of yields of existing sources
        f. Improvement of water quality including control of naturally occurring chlorides
        g. Drought management
    - New supply development including:
        a. Construction and improvement of surface water and groundwater resources
        b. Brush control
        c. Precipitation enhancement
        d. Desalination
        e. Water supply that could be made available by cancellation of water rights
        f. Rainwater harvesting

    g. Aquifer storage and recovery

- Conservation and drought management measures including demand management
- Reuse of wastewater
- Interbasin transfers of surface water
- Emergency transfers of surface water

7. Consider other *potentially feasible water management strategies* suggested by planning group members, stakeholders, and the public.
8. Based on the above reviews and considerations, establish a preliminary list of *potentially feasible water management strategies*. At a discussion level, consider the following feasibility concerns for each strategy:
    - Water supply source availability during drought-of-record conditions
    - Cost/benefit
    - Water quality
    - Threats to agriculture and natural resources
    - Impacts to the environment, other water resources, and basin transfers
    - Socio-economic impacts
9. Based on the above discussion level analysis, select a final list of *potentially feasible water management strategies* for further technical evaluation using detailed analysis criteria.

Using the above criteria and process, the FWTWPG selected the initial *potentially feasible water management strategies* listed in Table 5-1 for further detailed analysis. As the water management strategy analysis progressed, it became evident that the initial list would require modification of project descriptive names, and the possible addition of new strategies and the elimination or transfer of others. Much time was spent in communication with individual WUGs (municipalities, irrigation districts, etc.) to ensure that the strategies discussion met with their approval. The evaluation and final recommendation of water management strategies are provided in the following Section 5.2.

Although these strategy types were considered by the FWTWPG, not all of them were considered viable options for addressing long-term needs in the region. The FWTWPG does not consider drought management as a feasible strategy to meet long-term growth in demands or current needs. This strategy is considered a temporary measure aimed at conserving available water supplies during times of drought or emergencies. Drought management is most adequately addressed in the region through the implementation of local drought contingency plans. The FWTWPG is supportive of the development and use of these plans during periods of drought or emergency water needs.

Table 5-1. Far West Texas Potentially Feasible Water Management Strategies

County	Water User Group	WMS#	Strategy	Source
Brewster	Brewster County Other (Marathon WSSService)	E-1	Water loss audit and main-line repair	Conservation
	Lajitas Municipal Services	E-2	Water loss audit and main-line repair	Conservation
	Brewster County Other (Study Butte Terlingua WS)	E-3	Water loss audit and main-line repair	Conservation
Culberson	**Culberson County Irrigation	E-4a	Conservation - Irrigation scheduling	Conservation
		E-4b	Conservation - Tailwater reuse	Conservation
		E-4c	Conservation - Improvements to water district delivery system	Conservation
		E-5	Additional groundwater wells	West Texas Bolsons Aquifer / Wild Horse Flat
El Paso	Town of Anthony	E-6	Arsenic treatment facility	Mesilla Bolson Aquifer
		E-7	Additional groundwater well	Hueco-Mesilla Bolson Aquifer
	**El Paso Water	E-8	Municipal conservation programs	Conservation
		E-9	Advanced water purification at the Bustamante WWTP	Reuse Treated Wastewater
		E-10	Expansion of current Hueco Bolson ASR	Rio Grande
		E-18	Lower Valley well-head RO	Hueco-Mesilla Bolson Aquifer
		E-12	Expansion of the Kay Bailey Hutchison Desal Plant	Hueco Bolson Aquifer
		E-13	Riverside Regulating Reservoir	Rio Grande & Stormwater Run-off
		E-14	Groundwater from Dell City Area (Phase 1)	Capitan Reef Complex Aquifer
		E-15	Groundwater from Dell City Area (Phase 2)	Bone Spring-Victorio Peak Aquifer
	**Lower Valley Water District	E-23	Public conservation education	Conservation
		E-24	Purchased water from EPW	EPW Blended Source
		E-25	Surface water treatment plant & transmission line	Rio Grande
		E-26	Groundwater from proposed Well field	Other Aquifer / Rio Grande Alluvium
		E-27	Groundwater from proposed Well field	Hueco Bolson Aquifer

Table 5-1. (Continued) Far West Texas Potentially Feasible Water Management Strategies

County	Water User Group	WMS#	Strategy	Source
El Paso		E-28	Wastewater treatment facility and ASR	Reuse Treated Wastewater
	**Horizon Regional MUD	E-29	Water loss audit and main-line repair	Conservation
		E-30	Public conservation education	Conservation
		E-31	Additional wells & expansion of desal plant	Hueco Bolson & Other Aquifer / Rio Grande Alluvium Aquifer
	Haciendas Del Norte WID	E-32	Water loss audit and main-line repair	Conservation
	East Montana WS	E-33	Water loss audit and main-line repair	Conservation
	El Paso County Tornillo WID	E-34	Additional groundwater well & transmission line	Hueco Bolson Aquifer
		E-35	Arsenic treatment facility	Hueco Bolson Aquifer
	**El Paso County Other (Vinton Hills)	E-36	Public conservation education	Conservation
		E-37	Purchased water from EPW	EPW Blended Source
		E-38	High capacity water lines for improved distribution of water from EPW	EPW Blended Source
	**El Paso County Irrigation (EPCWID #1)	E-39	Irrigation scheduling	Rio Grande Run-of-River
		E-40	Tailwater reuse	Rio Grande Run-of-River
		E-41	Improvements to water district delivery system	Rio Grande Run-of-River
	**El Paso County Manufacturing	E-42	Manufacturing Conservation	Conservation
		E-43	Purchased water from EPW	EPW Blended Source
	**El Paso County Mining	E-44	Mining Conservation	Conservation
		E-45	Additional groundwater wells	Hueco-Mesilla Bolson Aquifer
	**El Paso County Steam Electric Power	E-46	Power Conservation	Conservation
		E-47	Purchased water from EPW	EPW Blended Source
Hudspeth	Hudspeth County Other (Dell City)	E-48	Brackish groundwater desal facility	Bone Spring-Victorio Peak Aquifer
	Hudspeth County Other (Fort Hancock WCID)	E-49	Additional well & RO treatment facility	Hueco-Mesilla Bolson Aquifer
	**Hudspeth County Other (City of Sierra Blanca - Hudspeth Co. WCID #1)	E-50	Public conservation education	Conservation
		E-51	Additional transmission line to supply connections outside of the District	West Texas Bolsons Aquifer / Salt Basin
	**Hudspeth County Mining	E-52	Mining Conservation	Conservation
		E-53	Additional groundwater well	West Texas Bolsons Aquifer / Eagle Flat

Table 5-1. (Continued) Far West Texas Potentially Feasible Water Management Strategies

County	Water User Group	WMS#	Strategy	Source
Jeff Davis	Fort Davis WSC	E-54	Additional transmission line to connect Fort Davis WSC to Fort Davis Estates	Igneous Aquifer
	Jeff Davis County Other (Town of Valentine)	E-55	Additional groundwater well	West Texas Bolsons Aquifer / Salt Basin
Presidio	**City of Presidio	E-56	Water loss audit and main-line repair	Conservation
		E-57	Additional groundwater well	West Texas Bolsons Aquifer / Presidio-Redford
Terrell	**Terrell County Mining	E-58	Mining Conservation	Conservation

** WUGs with supply needs

5.2 EVALUATION AND RECOMMENDATION OF WATER MANAGEMENT STRATEGIES

5.2.1 Strategy Evaluation Procedure

The strategy evaluation procedure is designed to provide a side-by-side comparison such that all strategies can be assessed based on the same quantifiable factors as shown in Tables 5-2, 5-3 and 5-4. An explanation of the qualitative and quantifiable rankings is provided in Appendix 5B. All strategy analyses recognize and protect existing water rights, water contracts, and option agreements. For planning purposes, it is assumed that all strategies experience a two percent water loss over the life of the strategy project. Specific factors considered in each Table were:

<u>Table 5-2</u>

- Quantity of new water supply produced
- Total capital cost
- Chemical quality
- Reliability of supply
- Impacts to water, agricultural, and natural resources, and to ecologically unique stream segments

<u>Table 5-3</u>

- Financial cost (total capital cost, annual cost, and cost per acre-foot)

<u>Table 5-4</u>

- Environmental impacts
    - Environmental water needs
    - Wildlife habitat
    - Cultural resources
    - Environmental water quality
    - Inflows to bays and estuaries

Cost evaluations for all strategies include capital cost, debt service, and annual operating and maintenance (O&M) expenses and are estimated based on September 2018 US dollars. Capital costs consider construction costs, engineering and feasibility studies, legal assistance, financing, bond counsel and contingencies, permitting and mitigation, land purchase not associated with mitigation, easement costs, and purchase of water rights. The length of debt service is 20 years unless otherwise stated. An annual unit cost is also calculated based on the O&M cost per acre-foot of water supplied. The TWDB Unified Costing Tool was used for all strategy evaluations except for when specific municipalities provided engineering design studies that included cost estimates.

Water quality is recognized as an important component in this 50-year water plan. To ensure that this *Plan* fully considers water quality, the Federal Clean Water Act and the State Clean Rivers Program were reviewed and considered when developing water management strategies and water quality impacts. Development of water management strategies were also guided by the principal that the designated water quality and related water uses described in the Water Quality Management Plans (WQMPs) of TCEQ and the Texas State Soil and Water Conservation Board (TSSWCB) were improved or maintained. TCEQ's WQMP is tied to the State's water quality assessments that identify and direct planning for implementation measures that control and/or prevent priority water quality problems. Elements contained in the WQMP include effluent limitations of wastewater facilities, total maximum daily loads (TMDLs), nonpoint source management controls, identification of designated management agencies, and ground water and source water protection planning. TSSWCB's WQMP is a site-specific plan developed through and approved by soil and water conservation districts for agricultural or sylvicultural lands. The plan includes appropriate land treatment practices, production practices, management measures, and technologies.

The FWTWPG relied on Management Supply Factors calculated and supplied by TWDB in the consideration of water-supply needs to be generated in the development of water management strategies. A Management Supply Factor is the combined total of existing and future supply divided by the total projected demand and may be used to take into account uncertainties in population, water supply and demand, and other impactful conditions. Management Supply Factors are shown for all WUGs in a table provided in the Executive Summary. Management Supply Factors for Major Water Providers are as follows:

MWP Name	Management Supply Factor					
	2020	2030	2040	2050	2060	2070
El Paso Water	1.2	1.1	1.2	1.2	1.2	1.2
Horizon Regional MUD	2.6	1.9	1.5	1.2	1.1	0.9
Lower Valley Water District	5.2	4.7	4.3	3.9	3.6	3.4
El Paso County Irrigation (EPCWID#1)	1	1	1	1	1	1

The development of water management strategies is intended to assist entities with their future water supply needs based on drought-of-record conditions. Recommendations of the Drought Preparedness Council for the 2016 Plans consisted of four activities: (1) Drought Monitoring; (2) Impact Assessment; (3) Research and Educational Programs; and (4) Drought Mitigation Strategies. For the current 2021 Plan, the Council prepared a drought-chapter outline to be followed by all Regions to ensure similar procedures were followed statewide in the preparation of Drought Chapter 7. Also, WUGs conservation and drought management plans (see Chapters 5 and 7) were reviewed to identify potential strategies that are currently under consideration by the entity.

El Paso Water's water management strategies (E-10 through E-23) are described as "Integrated Strategies" meaning that the operation of the entire water supply system is not dependent on any one or more individual facilities, but rather draws from each source at a rate that is optimal for the entire system under the existing circumstances. Although the strategy facilities will work together to provide necessary supplies, each strategy is independent of the others and does not rely on or mutually exclude any other strategy. All other strategies in this *Plan* likewise do not rely on or mutually exclude any other strategies.

5.2.2 Emphasis on Conservation and Reuse

In terms of recommending strategies to meet future water needs, it is most practical and often most economical to consider potential conservation and reuse projects. Conservation generally includes best management practices that are undertaken either voluntarily by water customers or as mandated by a water supplier. Conservation savings are the result of "active" water conservation strategies that conserve water over and beyond what would happen anyway as a result of "passive" water conservation measures that stem from federal and state legislation requiring more efficient plumbing fixtures in new building construction. Existing WUG conservation and drought management plans were reviewed, and conservation strategies selected for this *Plan* were often identified from these plans.

Reported municipal use generally includes a variable amount of water that does not reach the intended consumer due to water leaks in the distribution lines, unauthorized consumption, storage tank overflows, and other wasteful factors. For some communities, attending to these issues can be a proactive conservation strategy that may result in significant water savings.

Over the last few years, the TWDB has seen a growing number of requests from municipalities throughout Texas to finance smart meters and advanced metering infrastructure (AMI). This technology allows meters to be read electronically via a fixed network that enables two-way communication with the utility system. More importantly, AMI's biggest advancement is the ability to monitor meters in real time to obtain more accurate data on water usage throughout the system. With the distribution network in constant communication, leaks and water loss can be detected earlier. This technological upgrade is more efficient than its counterpart, the automatic meter readers (AMR), that are still widely used and require meters to be manually read.

Reuse of treated wastewater is also an excellent strategy for producing additional water supplies from existing developed sources, or for use in areas where drinking water is not required such as irrigation. Reuse strategies were particularly considered for El Paso Water.

5.2.3 Water Loss Audit Strategies

To address the lack of information on water loss, the 78th Texas Legislature passed House Bill 3338, which requires retail public utilities that provide potable water to perform and file with the TWDB a water audit computing the utility's most recent annual system water loss every five years (see further discussion in Chapter 1 Section 1.9). Entities reporting more than a 10 percent water loss were selected to receive a water-loss audit and line replacement strategy.

Across Far West Texas, it is estimated that around 373 acre-feet of supply could be obtained through a water loss audits and leak repairs program in 2020. The reliability of this supply is low due to uncertainty associated with estimated savings and the extent to which this strategy relies on individual utilities to adopt a water loss audits and leak repairs program, which can be costly and time intensive, especially for smaller users. Due to the relatively high costs of implementing this strategy, especially for smaller or rural water user groups, this strategy may not be feasible.

System water audits and water loss programs are effective methods of accounting for all water usage by a public utility within its service area. The structured approach of a water audit allows a utility to reliably track water uses and provide the information to address unnecessary water and revenue losses. The resulting information from a water audit will be valuable in setting performance indicators and in establishing goals and priorities for cost-effectively reducing water losses. By adopting this Best Management Practice (BMP), utilities will more frequently implement water auditing and loss reduction techniques than required by HB 3338. A more detailed description of this best management practice is available in TWDB Report 362, Water Conservation Best Management Practices Guide, and in the TWDB Water Loss Manual, or at https://www.twdb.texas.gov/conservation/BMPs/index.asp and https://www.twdb.texas.gov/conservation/resources/waterloss-resources.asp. The reliability of this water savings is contingent on the aggressive implementation of this BMP and the public's willingness to do their part.

5.2.4 Assessment of ASR Potential

Texas Water Code §16.053(e)(10) requires that "if a RWPA has significant identified water needs, the RWPG shall provide a specific assessment of the potential for aquifer storage and recovery (ASR) projects to meet those needs". The FWTWPG considers municipal utilities as the only WUGs in the Far West Texas Region that would have the resources available to initiate an ASR project; and that the threshold for "significant" identified water needs are defined by the FWTWPG as any municipal utility with greater than 20,000 acre-feet per year need over the 50-year planning horizon. This horizon only occurs with El Paso Water. All other municipal water needs are at a less significant level. El Paso Water is currently exercising an ASR project, and an expansion of this project is a recommended water management strategy in this *Plan*.

5.2.5 Direct Reuse Strategies

Direct reuse strategies are developed for the City of Alpine, El Paso Water, and Lower Valley Water District. The City of Alpine will generate a 30 percent increase in the total allowable direct-reuse volume (25 acre-feet per year). El Paso Water's three "advanced water purification" projects come online during varying decades and will generate new supplies at rates calculated into their facility engineering design. Likewise, the Lower Valley Water District strategy includes a new treatment facility capable of generating the specified volume of direct-reuse supply. The volumes of new water supply made available by these projects are intended to satisfy a significant portion of new water demands generated from population growth.

5.2.6 Recommended Water Management Strategies

The strategy evaluation procedure, as described in Section 5.2.1 above, was followed on each of the potentially feasible strategies selected in Table 5-1. Some potential strategies were determined to not meet guideline standards and were thus eliminated. Also, several new strategies were introduced and were subsequently evaluated. Upon completion of the evaluation phase, the FWTWPG reviewed evaluation criteria and selected the final water management strategies listed in Table 5-2.

Seawater desalination, a major alternative water management solution for the coastal portion of Texas, was not selected for consideration in the Far West Texas Water Planning Region as the nearest direct point of origin for a seawater source is more than 300 miles from the easternmost border of the Far West Texas Region, and is thus not rationally economically feasible.

Third-party social and economic impacts resulting from voluntary redistributions of water, including impacts of moving water from rural and agricultural areas were considered. There are only two strategies (E-16 and E-17) owned by El Paso Water that are impacted by this analysis. Strategy E-16 moves water from currently irrigated farmland in Culberson County to El Paso to El Paso County. This farmland is currently owned by El Paso Water and, therefore, the conversion of use from irrigation to municipal is El

Paso Water's decision. Strategy E-17 moves water from the Dell City area of Hudspeth County to El Paso County. El Paso Water is purchasing land and water rights from willing landowners, and therefore the conversion of use from irrigation to municipal is voluntary.

A comparative listing of all water management strategies that the FWTWPG subsequently recommends in total for inclusion in the 2021 Far West Texas Water Plan is provided in Table 5-2. Table 5-3 provides a breakdown of the cost estimate for each strategy, and Table 5-4 shows potential impacts of enacting each strategy. Strategy evaluations are presented in Appendix 5A at the end of this chapter. The total capital cost for development of all water management strategies is $2,110,409,105.

To adequately consider the unique challenges faced by municipal and industrial water users in El Paso County, a conjunctive approach was used to establish feasible strategies capable of identifying sufficient future supplies to meet the needs of El Paso Water, the largest wholesale water provider in the county.

The evaluation of some irrigation strategies for El Paso and Hudspeth Counties differs slightly in that these strategies consider recommended management practices and are discussed in detail in a regional planning study titled *Evaluation of Irrigation Efficiency Strategies for Far West Texas: Feasibility, Water Savings and Cost Considerations (2009)*.

5.2.7 Alternate Water Management Strategies

Alternate water management strategies are projects that are not part of the package of Recommended strategies, but can be substituted for any Recommended strategy that is later determined to be non-viable. Alternate water management strategies are evaluated in the same way as Recommended strategies based on criteria specified in [31 TAC §357.7(a)(7-9, 12)] and are tabulated along with "Recommended" strategies in Tables 5-2, 5-3 and 5-4. Upon conclusion of a thorough evaluation process, the FWTWPG identified nine Alternate water management strategies for El Paso Water and one for the mining category in Terrell County.

5.2.8 Unmet Needs

Sufficient water management strategy supplies are recommended to meet the identified projected needs of all water user groups (WUGs) in the Region except for the irrigation category in El Paso and Culberson Counties, and for the mining category in El Paso and Terrell Counties.

	WUG Unmet Needs (Acre-Feet Per Year)					
	2020	**2030**	**2040**	**2050**	**2060**	**2070**
Culberson Co. Irrigation			5,418	5,418	5,418	5,418
El Paso Co. Irrigation	9,691	9,691	9,691	9,691	9,691	9,691
El Paso Co. Mining					285	1,131
Terrell Co. Mining	483	586	550	416	293	195

The El Paso County WID#1 depends on flow in the Rio Grande as its primary irrigation supply source, and during drought-of-record conditions this source is significantly diminished or nonexistent. There are no other supply sources that can be tapped to make up the total needed volume of supply when the Rio Grande is at this stage. Culberson County irrigation unmet needs appear starting in the 2040 decade even with conservation considerations. The local Culberson County Groundwater Conservation District is monitoring water levels in the aquifer and will support local irrigators in realizing potential future shortage potentials.

Mining unmet needs in El Paso County do not appear until the 2060 decade. Groundwater use of local aquifers are significantly controlled by existing municipal and irrigation needs and therefore, future supplies available for mining use may rely on mining companies contracting for future water from existing users. Mining unmet needs in Terrell County result from pumping limitations set by the Terrell County Groundwater Conservation District. A change in DFC and MAG availabilities in future planning cycles, or by a rule modification by the District could make more water supplies available in the future.

5.2.9 Unqualified Strategies

The TWDB requires that water management strategies listed in regional water plans develop "new" water supplies to be applicable for SWIFT funding. Projects that involve items such as; replacing and/or repairing old infrastructure, and wastewater collection and treatment do not qualify. However, the TWDB offers many other types of financing options. Additional details pertaining to the different types of grants and loans offered can be accessed here: https://www.twdb.texas.gov/financial/index.asp.

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Table 5-2. Summary of Recommended and Alternate Water Management Strategy Evaluations
(All strategies are in the Rio Grande River Basin)

County	Water User Group	Strategy	Source	Strategy ID	Strategy Supply (Acre-Feet/Year)						Total Capital Cost (Table 5-3)	Quantity[1]	Quality[2]	Reliability[3]	Strategy Impacts[4]			
					2020	2030	2040	2050	2060	2070					Water Resources (1-5)	Agricultural Resources (1-5)	Natural Resources (1-5)	Ecologically Unique Stream Segments (1-5)
Brewster	City of Alpine	Modification to wastewater treatment facility & irrigation system	Direct Non-Potable Reuse	E-1		25	25	25	25	25	$2,318,000	NA	3	1	1	2	1	2
		Irrigation and recharge application of captured rainwater runoff	Demand Reduction	E-2		70	70	70	70	70	$1,296,000	NA	3	1	1	2	1	2
	Marathon WSSService	Water loss audit and main-line repair	Demand Reduction	E-3	12	12	12	12	12	12	$255,000	NA	NA	NA	1	2	2	2
	Lajitas Municipal Services	Water loss audit and main-line repair	Demand Reduction	E-4	51	51	51	51	51	51	$2,545,000	NA	NA	NA	1	2	2	2
	Brewster County Other (Study Butte Terlingua WS)	Water loss audit and main-line repair	Demand Reduction	E-5	25	25	25	25	25	25	$3,054,000	NA	NA	NA	1	2	2	2
Culberson	*Culberson County Irrigation	Irrigation scheduling	Demand Reduction	E-6	107	107	107	107	107	107	$0	3	NA	NA	1	1	1	2
		Additional groundwater wells	West Texas Bolsons Aquifer / Upper Salt Flat	E-7	333	333	333	333	333	333	$510,000	1	3	1	3	1	2	2
El Paso	Town of Anthony	Arsenic treatment facility	Mesilla Bolson Aquifer	E-8	2,800	2,800	2,800	2,800	2,800	2,800	$10,334,000	NA	1	1	NA	NA	NA	2
		Additional groundwater well	Hueco-Mesilla Bolson Aquifer	E-9	960	960	960	960	960	960	$1,913,000	NA	2	1	3	2	2	2
	*El Paso Water	Municipal conservation programs	Demand Reduction	E-10	4,950	5,530	5,080	9,940	13,140	17,820	$1,070,000	2	NA	NA	1	NA	NA	2
		Advanced water purification at the Bustamante WWTP	Direct Potable Reuse	E-11	8,500	9,200	9,900	10,600	10,600	10,600	$100,361,400	3	1	1	2	2	2	2
		Hueco Bolson artificial recharge	Hueco Bolson Aquifer	E-14		5,000	5,000	5,000	5,000	5,000	$38,003,000	3	2	2	1	2	3	2
		Groundwater from Dell City Area (Phase 1)	Capitan Reef Complex Aquifer	E-16			10,000	10,000	10,000	10,000	$569,357,000	3	1	1	2	5	2	2
		Groundwater from Dell City Area (Phase 2)	Bone Spring-Victorio Peak Aquifer	E-17				10,000	10,000	10,000	$320,226,000	3	1	1	2	5	2	2
	*El Paso Water ALTERNATE STRATEGIES	Treatment and reuse of agricultural drain water	Agricultural drain water	E-18			2,700	2,700	2,700	2,700	$21,466,000	3	2	2	1	2	2	2
		Expansion of the Kay Bailey Hutchison Desal Plant	Hueco Bolson Aquifer	E-13					5,000	5,000	$26,490,000	3	1	1	2	2	2	2
		Expansion of Canutillo Mesilla Bolson Well Field	Hueco-Mesilla Bolson Aquifer	E-19		7,760	11,640	15,520	19,400	23,280	$6,444,000	2	1	1	**3**	2	2	2
		Riverside Regulating Reservoir	Rio Grande & Stormwater Run-off	E-15			3,250	3,250	3,250	3,250	$6,754,036	3	2	2	2	2	1	2
		Lower Valley well head RO	Rio Grande Alluvium Aquifer	E-20			5,000	5,000	5,000	5,000	$52,681,000	3	1	1	3	2	2	2

Table 5-2. (Continued) Summary of Recommended and Alternate Water Management Strategy Evaluations
(All strategies are in the Rio Grande River Basin)

County	Water User Group	Strategy	Source	Strategy ID	Strategy Supply (Acre-Feet/Year)						Total Capital Cost (Table 5-3)	Quantity[1]	Quality[2]	Reliability[3]	Strategy Impacts[4]			
					2020	2030	2040	2050	2060	2070					Water Resources (1-5)	Agricultural Resources (1-5)	Natural Resources (1-5)	Ecologically Unique Stream Segments (1-5)
El Paso	*El Paso Water ALTERNATE STRATEGIES	Expansion of Jonathan Rogers WTP	Rio Grande	E-21			6,500	6,500	6,500	6,500	$88,679,000	3	1	2	2	2	2	2
		Conjunctive treatment of groundwater and surface water at the Upper Valley WWTP	Rio Grande	E-22		10,000	10,000	10,000	10,000	10,000	$72,873,000	3	1	2	2	2	2	2
		Advanced water purification at the Haskell Street RWP	Direct Potable Reuse	E-12						10,000	$189,356,000	3	1	1	2	2	2	2
		Advanced water purification at the Fred Hervey WWTP	Direct Potable Reuse	E-23			10,000	10,000	10,000	10,000	$140,394,000	3	1	1	2	2	2	2
	*Lower Valley Water District	Public conservation education	Demand Reduction	E-24	57	66	74	83	92	100	$0	3	NA	NA	1	NA	NA	2
		Purchase water from EPW	EPW Blended Source	E-26	1,344	2,185	3,012	3,895	4,785	5,632	$0	2	1	1	2	2	2	2
		Surface water treatment plant & transmission line	Rio Grande	E-27		5,000	5,000	5,000	5,000	5,000	$74,338,000	2	1	2	2	5	2	2
		Groundwater from proposed Well field	Rio Grande Alluvium Aquifer	E-28		6,800	6,800	6,800	6,800	6,800	$39,236,000	1	1	1	3	2	2	2
		Groundwater from proposed Well field	Hueco Bolson Aquifer	E-29		6,800	6,800	6,800	6,800	6,800	$36,110,000	1	1	1	3	2	2	2
		Wastewater treatment facility and ASR	Reuse Treated Wastewater	E-30		5,589	5,589	5,589	5,589	5,589	$23,509,000	1	2	1	1	2	2	2
	*Horizon Regional MUD	Water loss audit and main-line repair	Demand Reduction	E-31	197	274	346	418	487	551	$255,000	3	NA	NA	1	2	2	2
		Public conservation education	Demand Reduction	E-32	79	110	140	169	196	222	$0	3	NA	NA	1	NA	NA	2
		Additional wells & expansion of desalination plant	Hueco Bolson & Rio Grande Alluvium Aquifers	E-33	16,786	16,786	16,786	16,786	16,786	16,786	$71,809,000	2	1	1	3	2	2	2
	Haciendas Del Norte WID	Water loss audit and main-line repair	Demand Reduction	E-34	12	13	15	16	17	19	$764,000	NA	NA	NA	1	2	2	2
	East Montana WS	Water loss audit and main-line repair	Demand Reduction	E-35	41	46	50	54	59	63	$1,018,000	NA	NA	NA	1	2	2	2
	El Paso County Tornillo WID	Additional groundwater well & transmission line	Hueco Bolson Aquifer	E-36	333	333	333	333	333	333	$2,060,000	NA	1	1	3	2	2	2
	*El Paso County Other (Vinton Hills)	Public conservation education	Demand Reduction	E-37	0	0	0	4	5	5	$0	3	NA	NA	1	NA	NA	2
		Purchase water from EPW	EPW Blended Source	E-38				10	73	133	$0	1	1	1	2	2	2	2
	*El Paso County Irrigation (EPCWID #1)	Irrigation scheduling	Demand Reduction	E-40	1,740	1,740	1,740	1,740	1,740	1,740	$102,595	3	NA	NA	1	1	2	2

Table 5-2. (Continued) Summary of Recommended and Alternate Water Management Strategy Evaluations
(All strategies are in the Rio Grande River Basin)

County	Water User Group	Strategy	Source	Strategy ID	Strategy Supply (Acre-Feet/Year)						Total Capital Cost (Table 5-3)	Quantity[1]	Quality[2]	Reliability[3]	Strategy Impacts[4]			
					2020	2030	2040	2050	2060	2070					Water Resources (1-5)	Agricultural Resources (1-5)	Natural Resources (1-5)	Ecologically Unique Stream Segments (1-5)
El Paso	*El Paso County Irrigation (EPCWID #1)	Tailwater reuse	Demand Reduction	E-41	1,723	1,723	1,723	1,723	1,723	1,723	$973,368	3	NA	NA	1	1	2	2
		Improvements to water district delivery system	Demand Reduction	E-42	25,000	25,000	25,000	25,000	25,000	25,000	$157,777,783	1	NA	NA	1	1	2	2
		Riverside Regulating Reservoir	Rio Grande & Stormwater Run-off	E-43		3,250	3,250	3,250	3,250	3,250	$6,754,036	3	3	2	2	1	1	2
		New Wasteway 32 River Diversion Pumping Point	Rio Grande	E-44	5,000	5,000	5,000	5,000	5,000	5,000	$4,055,887	3	3	2	1	1	2	2
	*El Paso County Manufacturing	Purchase water from EPW	EPW Blended Source	E-46		860	860	860	860	860	$0	1	3	1	2	2	2	2
	*El Paso County Mining	Additional groundwater wells	Hueco-Mesilla Bolson Aquifer	E-48	4,251	4,251	4,251	4,251	4,251	4,251	$1,208,000	2	3	1	3	2	2	2
	*El Paso County Steam Electric Power	Purchase water from EPW	EPW Blended Source	E-50	7,260	7,260	7,260	7,260	7,260	7,260	$0	1	3	1	2	2	2	2
Hudspeth	Hudspeth County Other (Dell City)	Brackish groundwater desal facility	Bone Spring-Victorio Peak Aquifer	E-51		111	111	111	111	111	$1,636,000	NA	1	1	2	2	2	2
	*Hudspeth County Other (City of Sierra Blanca - Hudspeth Co. WCID #1)	Public conservation education	Demand Reduction	E-52	1	2	2	2	2	2	$0	NA	NA	NA	1	2	2	2
		Replace water-supply line from Van Horn	West Texas Bolsons Aquifer / Wild Horse Flat	E-53		39	39	39	28	0	$18,432,000	NA	NA	NA	1	2	2	2
		Local groundwater well	Diablo Plateau Aquifer	E-54	16	16	16	16	16	16	$940,000	NA	1	1	3	2	2	2
		Groundwater well NE of Van Horn	West Texas Bolsons Aquifer / Wild Horse Flat	E-55	39	39	39	39	39	0	$2,132,000	NA	1	1	2	2	2	2
		Groundwater well West of Van Horn	Diablo Plateau Aquifer	E-56	39	39	39	39	39	39	$636,000	NA	2	1	3	2	2	2
	*Hudspeth County Mining	Additional groundwater well	West Texas Bolsons Aquifer / Eagle Flat	E-58	219	219	219	219	219	219	$306,000	1	3	1	3	2	2	2
Jeff Davis	Fort Davis WSC	Additional groundwater well	Igneous Aquifer	E-59	274	274	274	274	274	274	$584,000	NA	1	1	3	2	2	2
		Transmission line to connect Fort Davis WSC to Fort Davis Estates	Igneous Aquifer	E-60		114	114	114	114	114	$1,671,000	NA	NA	NA	NA	2	2	2
	Jeff Davis County Other (Town of Valentine)	Additional groundwater well	West Texas Bolsons Aquifer / Salt Basin	E-61	129	129	129	129	129	129	$783,000	NA	1	1	3	2	2	2
Presidio	City of Presidio	Water loss audit and main-line repair	Demand Reduction	E-62	35	37	38	41	43	45	$509,000	NA	NA	NA	1	2	2	2
		Additional groundwater well	West Texas Bolsons Aquifer / Presidio-Redford	E-63	120	120	120	120	120	120	$5,509,000	NA	1	1	3	2	2	2
Terrell	*Terrell County Mining ALTERNATE STRATEGY	Additional groundwater wells	Edwards-Trinity (Plateau) Aquifer	E-65	470	470	470	470	470	470	$921,000	2	1	3	3	2	2	2

* WUG with a projected future supply deficit. (*See Table 4-1 for list of shortages) and See Appendix 5B for quantification description of impact ranges.*

Table 5-3. Summary of Recommended and Alternate Water Management Strategy Cost

County	Water User Group	Strategy	2021 Strategy ID	Total Capital Cost**	Total Annual Cost						Cost per Acre-Foot/Year					
					2020	2030	2040	2050	2060	2070	2020	2030	2040	2050	2060	2070
Brewster	City of Alpine	Modification to wastewater treatment facility & irrigation system	E-1	$2,318,000		$223,000	$223,000	$60,000	$60,000	$60,000		$8,920	$8,920	$2,400	$2,400	$2,400
		Irrigation application of captured rainwater runoff	E-2	$1,296,000		$114,000	$114,000	$23,000	$23,000	$23,000		$1,520	$1,520	$307	$307	$307
	Brewster County Other (Marathon WSSService)	Water loss audit and main-line repair	E-3	$255,000	$18,000	$18,000	$18,000	$18,000	$18,000	$18,000	$1,500	$1,500	$1,500	$1,500	$1,500	$1,500
	Lajitas Municipal Services	Water loss audit and main-line repair	E-4	$2,545,000	$179,000	$179,000	$179,000	$179,000	$179,000	$179,000	$3,510	$3,510	$3,510	$3,510	$3,510	$3,510
	Brewster County Other (Study Butte Terlingua WS)	Water loss audit and main-line repair	E-5	$3,054,000	$215,000	$215,000	$215,000	$215,000	$215,000	$215,000	$8,600	$8,600	$8,600	$8,600	$8,600	$8,600
Culberson	*Culberson County Irrigation	Conservation - Irrigation scheduling	E-6	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
		Additional groundwater wells	E-7	$510,000	$54,000	$54,000	$18,000	$18,000	$18,000	$18,000	$162	$162	$54	$54	$54	$54
El Paso	Town of Anthony	Arsenic treatment facility	E-8	$10,334,000	$1,574,000	$1,574,000	$847,000	$847,000	$847,000	$847,000	$562	$562	$302	$302	$302	$302
		Additional groundwater well	E-9	$1,913,000	$192,000	$192,000	$72,000	$72,000	$72,000	$72,000	$200	$200	$65	$65	$65	$65
	*El Paso Water	Municipal conservation programs (1)	E-10	$1,071,000	$1,071,000	$1,071,000	$1,071,000	$1,071,000	$1,071,000	$1,071,000	$216	$194	$211	$108	$82	$60
		Advanced water purification at the Bustamante WWTP (3)	E-11	$100,361,400	$5,070,600	$5,070,600	$2,565,000	$2,565,000	$2,565,000	$2,565,000	$1,255	$1,255	$474	$474	$474	$474
		Hueco Bolson Artificial Recharge (4)	E-14	$38,003,000	--	$2,367,000	$2,367,000	$416,000	$416,000	$416,000	--	$473	$473	$251	$251	$251
		Groundwater from Dell City Area (Phase 1) (13)	E-16	$569,357,000	--	--	$46,984,000	$46,984,000	$6,923,000	$6,923,000	--	--	$4,698	$4,698	$692	$692
		Groundwater from Dell City Area (Phase 2) (13)	E-17	$320,226,000	--	--	--	$38,010,000	$38,010,000	$15,479,000	--	--	--	$3,801	$3,801	$1,548
	*El Paso Water ALTERNATE STRATEGIES	Treatment and reuse of agricultural drain water (5)	E-18	$21,466,000	--	--	$2,538,000	$2,538,000	$1,028,000	$1,028,000	--	--	$940	$940	$381	$381
		Expansion of the Kay Bailey Hutchison Desal Plant (8)	E-13	$26,490,000	--	--	--	--	$4,441,000	$4,441,000	--	--	--	--	$888	$888
		Riverside Regulating Reservoir (12)	E-15	$6,754,036	--	--	$475,221	$475,221	$77,120	$77,120	--	--	$368	$368	$51	$51
		Expansion of Canutillo Mesilla Bolson Well Field (6)	E-19	$6,444,000	--	$521,000	$521,000	$68,000	$68,000	$68,000	--	$537	$537	$70	$70	$70
		Lower Valley well head RO (7)	E-20	$52,681,000	--	--	$6,995,000	$6,995,000	$3,288,000	$3,288,000	--	--	$1,399	$1,399	$658	$658
		Expansion of Jonathan Rogers WTP (11)	E-21	$88,679,000	--	--	$9,000,000	$9,000,000	$2,761,000	$2,761,000	--	--	$1,385	$1,385	$425	$425
		Conjunctive treatment of groundwater and surface water at the Upper Valley WWTP (14)	E-22	$72,873,000	--	$8,476,000	$8,476,000	$3,714,000	$3,714,000	$3,714,000	--	$848	$848	$347	$347	$347
		Advanced water purification at the Haskell WWTP (2)	E-12	$189,356,000	--	--	--	--	--	$13,323,000	--	--	--	--	--	$2,948
		Advanced water purification at the Fred Hervey WWTP (15)	E-23	$140,394,000	--	--	$17,957,000	$17,957,000	$8,079,000	$8,079,000	--	--	$1,796	$1,796	$808	$808
	*Lower Valley Water District	Public conservation education	E-24	$0	$595,000	$595,000	$538,000	$538,000	$538,000	$538,000	$5,950	$5,950	$570	$570	$570	$570
		Purchased water from EPW	E-26	$0	$591,000	$961,000	$1,325,000	$1,714,000	$2,105,000	$2,478,000	$436	$436	$436	$436	$436	$436
		Surface water treatment plant & transmission line	E-27	$74,338,000		$7,455,000	$7,455,000	$2,225,000	$2,225,000	$2,225,000		$1,491	$1,491	$445	$445	$445

Table 5-3. (Continued) Summary of Recommended and Alternate Water Management Strategy Cost

County	Water User Group	Strategy	2021 Strategy ID	Total Capital Cost**	Total Annual Cost						Cost per Acre-Foot/Year					
					2020	2030	2040	2050	2060	2070	2020	2030	2040	2050	2060	2070
El Paso	*Lower Valley Water District	Groundwater from proposed Well field	E-28	$39,236,000		$10,232,000	$10,232,000	$7,471,000	$7,471,000	$7,471,000		$1,505	$1,505	$1,099	$1,099	$1,099
		Groundwater from proposed Well field	E-29	$36,108,000		$9,996,000	$9,996,000	$7,455,600	$7,455,600	$7,455,600		$1,470	$1,470	$1,096	$1,096	$1,096
		Wastewater treatment facility and ASR	E-30	$23,509,000		$2,839,000	$2,839,000	$1,185,000	$1,185,000	$1,185,000		$508	$508	$212	$212	$212
	*Horizon Regional MUD	Water loss audit and main-line repair	E-31	$255,000	$18,000	$18,000	$18,000	$18,000	$18,000	$18,000	$91	$66	$52	$43	$37	$33
		Public conservation education	E-32	$0	$19,714	$25,467	$23,917	$23,153	$22,509	$22,033	$248	$231	$171	$137	$115	$99
		Additional wells & expansion of desal plant	E-33	$71,809,000	$15,031,000	$15,031,000	$9,978,000	$9,978,000	$9,978,000	$9,978,000	$895	$895	$594	$594	$594	$594
	Haciendas Del Norte WID	Water loss audit and main-line repair	E-34	$764,000	$54,000	$54,000	$54,000	$54,000	$764,000	$54,000	$4,500	$4,154	$3,600	$3,375	$3,176	$2,842
	East Montana WS	Water loss audit and main-line repair	E-35	$1,018,000	$72,000	$72,000	$72,000	$72,000	$72,000	$72,000	$1,756	$1,565	$1,440	$1,333	$1,220	$1,143
	El Paso County Tornillo WID	Additional groundwater well & transmission line	E-36	$2,060,000	$0	$0	$225,000	$225,000	$80,000	$80,000	$676	$676	$676	$676	$240	$240
	*EL Paso County Other (Vinton Hills)	Public conservation education	E-37	$0	$883	$1,119	$1,059	$1,028	$1,002	$982	$919	$878	$678	$551	$464	$404
		Purchased water from EPW	E-38	$0	--	--	--	$15,000	$80,000	$143,000	--	--	--	$1,041	$1,041	$1,041
	*El Paso County Irrigation (EPCWID #1)	Irrigation scheduling	E-40	$0	$102,595	$102,595	$102,595	$102,595	$102,595	$102,595	$59	$59	$59	$59	$59	$59
		Tailwater reuse	E-41	$0	$973,368	$973,368	$973,368	$973,368	$973,368	$973,368	$565	$565	$565	$565	$565	$565
		Improvements to water district delivery system	E-42	$157,777,783	$216,155	$216,155	$216,155	$216,155	$216,155	$216,155	$9	$9	$9	$9	$9	$9
		Riverside Regulating Reservoir	E-43	$6,754,036		$475,221	$475,221	$77,120	$77,120	$77,120		$368	$368	$51	$51	$51
		New Wasteway 32 River Diversion Pumping Point	E-44	$4,055,887	$348,861	$348,861	$55,235	$55,235	$55,235	$55,235	$18	$18	$3	$3	$3	$3
	*El Paso County Manufacturing	Purchased water from EPW	E-46	$0	--	$1,049,000	$1,049,000	$1,049,000	$1,049,000	$1,049,000	--	$1,168	$1,168	$1,168	$1,168	$1,168
	*El Paso County Mining	Additional groundwater wells	E-48	$1,208,000	$173,000	$173,000	$88,000	$88,000	$88,000	$88,000	$41	$41	$21	$21	$21	$21
	*El Paso County Steam Electric Power	Purchased water from EPW	E-50	$0	$951,000	$951,000	$951,000	$951,000	$951,000	$951,000	$131	$131	$131	$131	$131	$131
Hudspeth	Hudspeth County Other (Dell City)	Brackish groundwater desal facility	E-51	$1,636,000		$329,000	$329,000	$214,000	$214,000	$214,000		$2,964	$2,964	$1,928	$1,928	$1,928
	*Hudspeth County Other (City of Sierra Blanca - Hudspeth Co. WCID #1)	Public conservation education	E-52	$0	$571	$622	$587	$583	$576	$575	$402	$412	$386	$381	$374	$371
		Replace water-supply line from Van Horn	E-53	$18,432,000		$1,454,000	$1,454,000	$157,000	$157,000			$37,282	$37,282	$4,026	$4,026	
		Additional groundwater well (local option)	E-54	$914,000	$134,000	$134,000	$70,000	$70,000	$70,000	$70,000	$8,375	$8,375	$4,375	$4,375	$4,375	$4,375
		Groundwater well NE of Van Horn	E-55	$2,132,000	$171,000	$171,000	$21,000	$21,000	$21,000	$21,000	$4,385	$4,385	$538	$538	$538	
		Groundwater well West of Van Horn	E-56	$636,000	$52,000	$52,000	$7,000	$7,000	$7,000	$7,000	$1,333	$1,333	$179	$179	$179	$179
	*Hudspeth County Mining	Additional groundwater well	E-58	$306,000	$32,000	$32,000	$10,000	$10,000	$10,000	$10,000	$146	$146	$46	$46	$46	$46

Table 5-3. (Continued) Summary of Recommended and Alternate Water Management Strategy Cost

County	Water User Group	Strategy	2021 Strategy ID	Total Capital Cost**	Total Annual Cost						Cost per Acre-Foot/Year					
					2020	2030	2040	2050	2060	2070	2020	2030	2040	2050	2060	2070
Jeff Davis	Fort Davis WSC	Additional groundwater well	E-59	$584,000	$78,000	$78,000	$37,000	$37,000	$37,000	$37,000	$285	$285	$135	$135	$135	$135
		Additional transmission line to connect Fort Davis WSC to Fort Davis Estates	E-60	$1,671,000		$144,000	$144,000	$26,000	$26,000	$26,000		$1,263	$1,263	$228	$228	$228
	Jeff Davis County Other (Town of Valentine)	Additional groundwater well	E-61	$783,000	$74,000	$74,000	$19,000	$19,000	$19,000	$19,000	$574	$574	$147	$147	$147	$147
Presidio	City of Presidio	Water loss audit and main-line repair	E-62	$509,000	$36,000	$36,000	$36,000	$36,000	$36,000	$36,000	$1,029	$973	$947	$878	$837	$800
		Additional groundwater well	E-63	$5,509,000	$490,000	$490,000	$102,000	$102,000	$102,000	$102,000	$4,083	$4,083	$850	$850	$850	$850
Terrell	*Terrell County Mining ALTERNATE STRATEGY	Additional groundwater wells	E-65	$921,000	$78,000	$78,000	$13,000	$13,000	$13,000	$13,000	$166	$166	$28	$28	$28	$28

* WUGs with a projected future supply deficit. *(See Table 4-1 for list of shortages)*

** Total Capital Costs are estimated based on September 2018 US dollars.

Table 5-4. Summary of Recommended and Alternate Water Management Strategy Environmental Assessments (Rio Grande River Basin)

County	Water User Group	Strategy	Strategy ID	Environmental Impact Factors **					Area Impacted and Resulting Conditions
				Water Needs (1-5)	Habitat (1-5)	Cultural Resources (1-5)	Water Quality (1-5)	Bays & Estuaries *** (1-5)	
Brewster	City of Alpine	Modification to wastewater treatment facility & irrigation system	E-1	1	1	2	1	NA	Intended to reduce water use.
		Irrigation application of captured rainwater runoff	E-2	1	1	2	1	NA	Intended to reduce water use. Temporary land disturbance during construction of facilities.
	Brewster County Other Marathon WSSService	Water loss audit and main-line repair	E-3	2	2	2	2	NA	Intended to reduce water loss.
	Lajitas Municipal Services	Water loss audit and main-line repair	E-4	2	2	2	2	NA	Intended to reduce water loss.
	Brewster County Other (Study Butte Terlingua WS)	Water loss audit and main-line repair	E-5	2	2	2	2	NA	Intended to reduce water loss.
Culberson	*Culberson County Irrigation	Irrigation scheduling	E-6	2	2	2	2	NA	Intended to reduce water use.
		Additional groundwater wells	E-7	2	3	2	2	NA	Temporary land disturbance during drilling of well and construction of connecting pipeline.
El Paso	Town of Anthony	Arsenic treatment facility	E-8	2	3	2	2	NA	Temporary land disturbance during construction of facilities.
		Additional groundwater well	E-9	2	3	2	2	NA	Temporary land disturbance during drilling of well and construction of connecting pipeline.
	*El Paso Water	Municipal conservation programs	E-10	2	2	2	2	NA	Intended to reduce water use.
		Advanced purified water at the Bustamante WWTP	E-11	2	3	2	2	NA	Temporary land disturbance during construction of facilities.
		Hueco Bolson Artificial Recharge	E-14	2	1	2	2	NA	Six spreading basins will be excavated on EPWU property, which will temporarily hold surface water for infiltration.
		Groundwater from Dell City Area (Phase 1)	E-16	2	3	2	2	NA	Temporary land disturbance during drilling of well and construction of connecting pipeline.
		Groundwater from Dell City Area (Phase 2)	E-17	2	3	2	2	NA	Temporary land disturbance during drilling of well and construction of connecting pipeline.
	*El Paso Water ALTERNATE STRATEGIES	Treatment and reuse of agricultural drain water	E-18	2 and 3	2	2	2	NA	Temporary land disturbance during construction of facilities. Reduced water in drains may occur.
		Advanced water purification at the Haskell WWTP	E-12	2	3	2	2	NA	Temporary land disturbance during construction of facilities.
		Expansion of the Kay Bailey Hutchison Desal Plant	E-13	2	3	2	2	NA	Temporary land disturbance during drilling of well and construction of connecting pipeline and plant expansion.
		Expansion of Canutillo Mesilla Bolson Well Field	E-19	2	3	2	2	NA	Temporary land disturbance during drilling of well and construction of connecting pipeline and plant expansion.
		Riverside Regulating Reservoir	E-15	1 and 3	1 and 3	2	2	NA	Construction of a 4,100 acre-foot ring levy regulating reservoir. Formally the location of several wastewater disposal ponds. Surface water impoundment habitat will be created; however, a minor amount of flood overflow will be diverted from downstream flow.
		Lower Valley well head RO	E-20	2	3	2	2	NA	Temporary land disturbance during drilling of well and construction of connecting pipeline and plant expansion.
		Expansion of Jonathan Rogers WTP	E-21	2	3	2	2	NA	Temporary land disturbance during construction of facilities.

Table 5-4. (Continued) Summary of Recommended and Alternate Water Management Strategy Environmental Assessments (Rio Grande River Basin)

County	Water User Group	Strategy	Strategy ID	Environmental Impact Factors **					Area Impacted and Resulting Conditions
				Water Needs (1-5)	Habitat (1-5)	Cultural Resources (1-5)	Water Quality (1-5)	Bays & Estuaries *** (1-5)	
El Paso	*El Paso Water ALTERNATE STRATEGIES	Conjunctive treatment of groundwater and surface water at the Upper Valley WWTP	E-22	2	3	2	2	NA	Temporary land disturbance during construction of facilities.
		Advanced water purification at the Fred Hervey WWTP	E-23	2	3	2	2	NA	Temporary land disturbance during construction of facilities.
	*Lower Valley Water District	Public conservation education	E-24	2	2	2	2	NA	Intended to reduce water use.
		Purchased water from EPWU	E-26	2	2	2	2	NA	Causes no change in existing conditions.
		Surface water treatment plant & transmission line	E-27	2	3	2	2	NA	Temporary land disturbance during construction of facilities.
		Groundwater from proposed Well field	E-28	2	3	2	2	NA	Temporary land disturbance during drilling of well and construction of connecting pipeline.
		Groundwater from proposed Well field	E-29	2	3	2	2	NA	Temporary land disturbance during drilling of well and construction of connecting pipeline.
		Wastewater treatment facility and ASR	E-30	2	2	3	2	NA	Temporary land disturbance during construction of facilities.
	*Horizon Regional MUD	Water loss audit and main-line repair	E-31	2	3	2	2	NA	Temporary land disturbance during construction of facilities.
		Public conservation education	E-32	2	2	2	2	NA	Intended to reduce water use.
		Additional wells & expansion of desal plant	E-33	2	3	2	2	NA	Temporary land disturbance during drilling of nine well and construction of connecting pipeline and plant expansion.
	Haciendas Del Norte WID	Water loss audit and main-line repair	E-34	2	2	2	2	NA	Intended to reduce water loss.
	East Montana WS	Water loss audit and main-line repair	E-35	2	2	2	2	NA	Intended to reduce water loss.
	El Paso County Tornillo WID	Additional groundwater well & transmission line	E-36	2	3	2	2	NA	Temporary land disturbance during drilling of well and construction of connecting pipeline.
	*EL Paso County Other (Vinton Hills)	Public conservation education	E-37	2	3	2	2	NA	Intended to reduce water use.
		Purchased water from EPW	E-38	2	2	2	2	NA	Causes no change in existing conditions.
	*El Paso County Irrigation (EPCWID #1)	Irrigation scheduling	E-40	2	3	2	2	NA	Intended to reduce water use.
		Tailwater reuse	E-41	2	2	2	2	NA	Intended to reduce water use.
		Improvements to water district delivery system	E-42	2	3	2	2	NA	Minor land disturbance will occur as existing canals are concrete lined.
		Riverside Regulating Reservoir	E-43	1 and 3	1 and 3	2	2	NA	Construction of a 4,100 acre-foot ring levy regulating reservoir. Formally the location of several wastewater disposal ponds. Surface water impoundment habitat will be created; however, a minor amount of flood overflow will be diverted from downstream flow.
		New Wasteway 32 River Diversion Pumping Point	E-44	2	3	2	2	NA	Intended to reduce water loss. Minor land disturbance will occur as existing canals are concrete lined.

Table 5-4. (Continued) Summary of Recommended and Alternate Water Management Strategy Environmental Assessments (Rio Grande River Basin)

County	Water User Group	Strategy	Strategy ID	Environmental Impact Factors ** Water Needs (1-5)	Habitat (1-5)	Cultural Resources (1-5)	Water Quality (1-5)	Bays & Estuaries *** (1-5)	Area Impacted and Resulting Conditions
El Paso	*El Paso County Manufacturing	Purchased water from EPW	E-46	2	2	2	2	NA	Causes no change in existing conditions.
El Paso	*El Paso County Mining	Additional groundwater wells	E-48	2	3	2	2	NA	Temporary land disturbance during drilling of well and construction of connecting pipeline.
El Paso	*El Paso County Steam Electric Power	Purchased water from EPW	E-50	2	2	2	2	NA	Causes no change in existing conditions.
Hudspeth	Hudspeth County Other (Dell City)	Brackish groundwater desal facility	E-51	2	2	2	2	NA	Causes no change in existing conditions.
Hudspeth	*Hudspeth County Other (City of Sierra Blanca - Hudspeth Co. WCID #1)	Public conservation education	E-52	2	2	2	2	NA	Intended to reduce water use.
Hudspeth	*Hudspeth County Other (City of Sierra Blanca - Hudspeth Co. WCID #1)	Replace water-supply line from Van Horn	E-53	2	2	2	2	NA	Temporary land disturbance during construction of connecting pipeline.
Hudspeth	*Hudspeth County Other (City of Sierra Blanca - Hudspeth Co. WCID #1)	Local groundwater well	E-54	2	2	2	2	NA	Temporary land disturbance during drilling of well and construction of connecting pipeline.
Hudspeth	*Hudspeth County Other (City of Sierra Blanca - Hudspeth Co. WCID #1)	Groundwater well NE of Van Horn	E-55	2	3	2	2	NA	Temporary land disturbance during drilling of well and construction of connecting pipeline.
Hudspeth	*Hudspeth County Other (City of Sierra Blanca - Hudspeth Co. WCID #1)	Groundwater well West of Van Horn	E-56	2	3	2	2	NA	Temporary land disturbance during drilling of well and construction of connecting pipeline.
Hudspeth	*Hudspeth County Mining	Additional groundwater well	E-58	2	3	2	2	NA	Temporary land disturbance during drilling of well and construction of connecting pipeline.
Jeff Davis	Fort Davis WSC	Additional groundwater well	E-59	2	3	2	2	NA	Temporary land disturbance during drilling of well and construction of connecting pipeline.
Jeff Davis	Fort Davis WSC	Additional transmission line to connect Fort Davis WSC to Fort Davis Estates	E-60	2	2	2	2	NA	Temporary land disturbance during construction of connecting pipeline.
Jeff Davis	Jeff Davis County Other (Town of Valentine)	Additional groundwater well	E-61	2	3	2	2	NA	Temporary land disturbance during drilling of well and construction of connecting pipeline.
Presidio	City of Presidio	Water loss audit and main-line repair	E-62	2	2	2	2	NA	Intended to reduce water loss.
Presidio	City of Presidio	Additional groundwater well	E-63	2	3	2	2	NA	Temporary land disturbance during drilling of well and construction of connecting pipeline.
Terrell	*Terrell County Mining ALTERNATE STRATEGY	Additional groundwater wells	E-65	2	3	2	2	NA	Temporary land disturbance during drilling of well and construction of connecting pipeline.

* WUGs with a projected future supply deficit. *(See Table 4-1 for list of shortages)*

** Strategy impact range: 1 = Positive; 2 = No New; 3 = Minimal Negative; 4 = Moderate Negative; 5 = Significant Negative *(See Appendix 5B for quantification description of impact ranges)*

*** All strategies occur beyond the distance of potential impact to flows into the coastal bay and estuary systems.

5.3 WATER CONSERVATION

Water conservation is one of the most important components of water supply management. According to the 2017 State Water Plan, the state's existing water supply is not sufficient to meet all future demands during times of drought. To meet the water demand in the year 2070, Texas would need to provide 8.9 million acre-feet of additional supplies, including water savings through conservation. Conservation was by far the most recommended strategy in all 16 regional water plans that formed the basis of the 2017 State Water Plan. Recognizing its impact, setting realistic goals and aggressively enforcing implementation may significantly extend the time when new supplies and associated infrastructure are needed. This chapter explores conservation opportunities and provides a road map for integrating conservation planning into long-range water supply management goals.

5.3.1 Water Conservation Overview

The Texas Water Development Board (TWDB) defines 'conservation' as those practices, techniques, programs, and technologies that will protect water resources, reduce the consumption of water, reduce the loss or waste of water, improve the efficiency in the use of water, or increase the recycling or reuse of water so that a water supply is made available for future or alternative uses. The mission of the water conservation staff is to provide leadership, planning, financial assistance, information and education for water conservation processes in Texas.

Effective conservation programs implement best management practices to try to meet the targets and goals identified within the plan and are important to water conservation planning for all entities such as: municipal, agricultural, industrial, and commercial. Water conservation management planning implemented by municipalities, water providers, and other water users supersede recommendations in this *Plan* and are considered consistent with this *Plan*.

The TWDB and the Texas State Soil and Water Conservation Board (TSSWCB) jointly conducted a study of ways to improve or expand water conservation efforts in Texas. The results of that study are available in a joint 2018 report titled "An Assessment of Water Conservation in Texas, Prepared for the 85th Texas Legislature" (http://www.twdb.texas.gov/publications/reports/special_legislative_reports/doc/TWDBTSSWCB_80th.pdf) and contains the following:

- An assessment of both agricultural and municipal water conservation issues;
- Information on existing conservation efforts by the TWDB and the TSSWCB;
- Information on existing conservation efforts by municipalities receiving funding from the TWDB, as specified in water conservation plans submitted by the municipalities as part of their applications for assistance;
- A discussion of future conservation needs;
- An analysis of programmatic approaches and funding for additional conservation efforts;
- An assessment of existing statutory authority and whether changes are needed to more effectively promote and fund conservation projects; and
- An assessment of the TWDB's agricultural water conservation program.

In addition, the TWDB in 2015 received funding from the Texas Legislature and hired a firm to perform a research project with the intent of measuring and quantifying the municipal water conservation efforts statewide. Interviews were conducted in each of the 16 regional planning areas with two primary goals: 1) Assist regional planners and the TWDB to quantify ongoing municipal conservation activities throughout the state and estimate regional water savings from activities adopted by the utilities; 2) To provide individual utilities with detailed reports and recommendations that will assist them to meet their own water conservation goals.

The TWDB Statewide Municipal Water Conservation Quantification Project surveyed two of the 22 municipalities within the Far West Texas region. Surveyed entities were El Paso Water and Horizon Regional MUD. Although only two entities were surveyed, these participating utilities portion of the recommended conservation supply accounts for approximately 94 percent of the annual savings to meet the 2070 supply volume for municipal water conservation region wide.

The report highlights a variety of conservation activities these two utilities have implemented and made recommendations to continue the effort, however it is not required by statute and administrative rules (31 TAC §357.34; 357.35) to develop strategies based on the findings of this report.

The Far West Texas water planning group has included the TWDB Statewide Municipal Water Conservation Quantification Project report as Appendix 5C and considers the document to be a valid resource for integrating conservation planning into long-range water supply management goals.

Texas Water Code §11.1271 requires water conservation plans for all municipal and industrial water users with surface water rights of 1,000 acre-feet per year or more and irrigation water users with surface water rights of 10,000 acre-feet per year or more. Also, all entities with 3,300 or more connections and/or a financial obligation with TWDB greater than $500,000 are required to submit water conservation plans. Water conservation plans of three entities in Far West Texas that meet these criteria were reviewed for this *Plan* including El Paso Water, El Paso County Water Improvement District No.1, and Hudspeth County Conservation and Reclamation District No.1. Water conservation plans are also required for all other water users applying for a State water right and may also be required for entities seeking State funding for water supply projects.

5.3.2 Model Water Conservation Plans

Water Conservation Plan forms are available from TCEQ in WordPerfect and PDF formats. The forms for the following entity types listed below are available at:
http://www.twdb.texas.gov/conservation/municipal/plans/index.asp

http://www.tceq.state.tx.us/permitting/water_supply/water_rights/conserve.htmlYou can receive a print copy of a form by calling 512/239-4691 or by email to wras@tceq.texas.gov.

Municipal Use – Utility Profile and Water Conservation Plan Requirements for Municipal Water Use by Public water Suppliers (TCEQ-10218) Word

Wholesale Public Water Suppliers – Profile and Water Conservation Plan Requirements for Wholesale Public Water Suppliers (TCEQ-20162) Word

Industrial Use – Industrial Water Conservation Plan (TCEQ-20839) Word

Mining Use – Mining Water Conservation Plan (TCEQ-20840) Word

Agricultural Uses – Agriculture Water Conservation Plan-Non-Irrigation (TCEQ-10541) Word

System Inventory and Water Conservation Plan for Individually-Operated Irrigation System (TCEQ-10238) Word

System Inventory and Water Conservation Plan for Agricultural Water Suppliers Providing Water to More Than One User (TCEQ-10244) Word

5.3.3 State Water Conservation Programs and Guides

The TWDB provides a significant amount of information and services pertaining to water conservation that can be accessed at: http://www.twdb.texas.gov/conservation/municipal/plans/index.asp

Likewise, water conservation tips developed by the TCEQ and made available through their Take Care of Texas educational campaign can be accessed at the following website: http://takecareoftexas.org/conservation-tips/conserve-our-water

Water-Saving Plumbing Fixture Program

The Texas Legislature created the Water-Savings Plumbing Fixture Program in 1992 to promote water conservation. Manufacturers of plumbing fixtures sold in Texas must comply with the Environmental Performance Standards for Plumbing Fixtures, which requires all plumbing fixtures such as showerheads, toilets and faucets sold in Texas to conform with specific water use efficiency standards.

As of January 1, 2014, Texas (HB 2667) mandates all toilets and urinals sold in Texas must meet new efficiency standards.

- Bath faucets cannot exceed 2.2 gallons per minute (GPM)
- Showerheads cannot exceed 2.5 gallons per minute (GPM)
- Kitchen faucets cannot exceed 2.2 gallons per minute (GPM)
- Toilets cannot exceed 1.28 gallons per flush (GPF)
- Urinals cannot exceed 0.5 gallons per flush (GPF)

Since more water is used in the bathroom than any other place in the home, water-efficient plumbing fixtures play an integral role in reducing water consumption, wastewater production, and consumers' water bills. It is estimated that switching to water-efficient fixtures can save the average household between $50 and $100 per year on water and sewer bills. Many hotels and office buildings find that water-efficient fixtures can save 20 percent on water and wastewater costs.

The EPA’s WaterSense program labels water-efficient products that meet most of the criteria above, and on average are certified to use at 20 percent less water than legacy fixtures. Their website also provides a product search tool and a rebate finder, and can be accessed here: https://www.epa.gov/watersense

Water Conservation Best Management Practices

The 78th Texas Legislature under Senate Bill 1094 created the Texas Water Conservation Implementation Task Force and charged the group with reviewing, evaluating, and recommending optimum levels of water use efficiency and conservation for the State. The TWDB and TCEQ in coordination with the Water Conservation Advisory Council prepared TWDB Report 362, Water Conservation Best Management Practices Guides for agricultural, commercial, institutional, and industrial water users. In addition, guides were developed for both municipal and wholesale water providers. These suggested BMPs are structured for delivering a conservation measure or series of measures that are useful, proven, cost-effective, and generally accepted among conservation experts. Each BMP structure has several elements that describe the efficiency measures, implementation techniques, schedule of implementation, scope, water savings estimating procedures, cost effectiveness considerations, and references to assist end-users in implementation. These documents can be accessed at the following TWDB website:

http://www.twdb.texas.gov/publications/reports/numbered_reports/doc/R362_BMPGuide.pdf

An update to the introduction in TWDB Report 362 can be found here:
http://www.twdb.texas.gov/conservation/BMPs/Ubmps/doc/MiniGuide.pdf?d=19543.519999831915

Public Water Conservation Education

Public education may be one of the most productive actions that can result in the greatest amount of water savings. Most citizens are willing to actively do their part to conserve water once the need is communicated and how to accomplish the most benefit is explained. Numerous state, county, and academic agencies provide educational material and demonstrations. Groundwater conservation districts also provide water conservation activities.

The TWDB provides a significant amount of information and services pertaining to water conservation that can be accessed at: http://www.twdb.texas.gov/conservation/municipal/plans/index.asp

Likewise, water conservation tips developed by the TCEQ and made available through their Take Care of Texas educational campaign can be accessed at the following website:
http://takecareoftexas.org/conservation-tips/conserve-our-water

TPWD also offers programs geared toward the appreciation and conservation of the state's outdoor natural resources (https://tpwd.texas.gov/landwater/water/conservation/ /) which include:

- Freshwater Inflows and Estuaries
- Coastal Studies
- River Studies
- Texas Gulf Ecological Management Sites

Education of our youth may be one of the best ways to spread the word about conservation of water. The TWDB provides excellent educational programs for all grade levels K-12th. Information pertaining to this program can be accessed at: https://www.twdb.texas.gov/conservation/education/kids/index.asp.

The Groundwater Conservation Districts in the Plateau Region have water conservation management goals that include:

- Publishing conservation articles in local newspapers;
- Providing conservation presentations and demonstrations at county shows;
- Conducting school programs relating to conservation issues; and
- Working with river authorities to promote the clean rivers program.

5.3.4 Regional Conservation Water Management Strategies

Many of the recommended water management strategies listed in Table 5-2 are classified as "Conservation". Conservation strategies are considered the first method of management when considering meeting future water needs. Conservation strategies include:

- Water loss audit and main-line repair
- Public conservation awareness
- Municipal supply conservation distribution
- Specified Irrigation, manufacturing and mining conservation practices

The *2021 Far West Texas Water Plan* recommends the following 24 conservation related strategies presented in Table 5-5.

Table 5-5. Summary of Recommended Conservation Water Management Strategy Evaluations

County	Water User Group	Strategy	2021 Strategy ID	Strategy Supply (Acre-Feet/Year)					
				2020	2030	2040	2050	2060	2070
Brewster	City of Alpine	Irrigation application of captured rainwater runoff	E-2	70	70	70	70	70	70
	Brewster County Other Marathon WSSService	Water loss audit and main-line repair	E-3	12	12	12	12	12	12
	Lajitas Municipal Services	Water loss audit and main-line repair	E-4	51	51	51	51	51	51
	Brewster County Other (Study Butte Terlingua WS)	Water loss audit and main-line repair	E-5	25	25	25	25	25	25
Culberson	Culberson County Irrigation	Irrigation scheduling	E-6	107	107	107	107	107	107
El Paso	City of El Paso (EPW)	Municipal conservation programs	E-10	4,950	5,530	5,080	9,950	13,140	17,820
	Lower Valley Water District	Public conservation education	E-24	57	66	74	83	92	100
	Horizon Regional MUD	Water loss audit and main-line repair	E-31	197	274	346	418	487	551
		Public conservation education	E-32	79	110	140	169	196	222
	Haciendas del Norte WID	Water loss audit and main-line repair	E-34	12	13	15	16	17	19
	East Montana WS	Water loss audit and main-line repair	E-35	41	46	50	54	59	63
	El Paso County Other	Public conservation education	E-37	2	3	3	4	5	5
	*El Paso County Irrigation (EPCWID #1)	Irrigation scheduling	E-40	1,740	1,740	1,740	1,740	1,740	1,740
		Tailwater reuse	E-41	1,723	1,723	1,723	1,723	1,723	1,723
		Improvements to water district delivery system	E-42	25,000	25,000	25,000	25,000	25,000	25,000

Table 5-5. (continued) Summary of Recommended Conservation Water Management Strategy Evaluations

County	Water User Group	Strategy	2021 Strategy ID	Strategy Supply (Acre-Feet/Year)					
				2020	2030	2040	2050	2060	2070
El Paso	EL Paso County Manufacturing	Manufacturing Conservation	E-45	0	430	430	430	430	430
	El Paso County Mining	Mining Conservation	E-47	278	370	466	569	680	807
	El Paso County Steam Electric Power	Steam Electric Power Conservation	E-49	3,630	3,630	3,630	3,630	3,630	3,630
Hudspeth	Hudspeth County Other (City of Sierra Blanca - Hudspeth Co. WCID #1)	Public conservation education	E-52	1	2	2	2	2	2
		Replace water-supply line from Van Horn	E-53	39	39	39	39	39	39
	Hudspeth County Mining	Mining Conservation	E-57	29	25	28	30	31	33
Presidio	City of Presidio	Water loss audit and main-line repair	E-62	35	37	38	41	43	45
Terrell	Terrell County Mining	Mining Conservation	E-64	72	88	83	62	44	29

5.3.5 Gallons Per Capita Daily Goals

Effective municipal conservation can best be monitored in terms of reduction in gallons per day per capita (gpcd). The FWTWPG recommends the gpcd reduction goals listed in Table 5-6, which provides a listing of projected gpcd reductions anticipated as water efficiency and recommended conservation savings occur on a decadal basis. Entities listed in the table with higher gpcds than 200 are likely impacted by water loss issues in their distribution systems. It is highly recommended that these entities take advantage of a water-loss audit to guide needed repairs.

Table 5-6. Gallons Per Capita Daily Goals

Water User Group	Base GPCD 2020	Adjusted 2020 GPCD	Adjusted 2030 GPCD	Adjusted 2040 GPCD	Adjusted 2050 GPCD	Adjusted 2060 GPCD	Adjusted 2070 GPCD
Alpine	294	285	281	277	275	275	275
Anthony	173	162	159	157	156	156	156
County-Other, Brewster	147	113	111	108	107	107	107
County-Other, Culberson	164	154	150	148	146	146	146
County-Other, El Paso	165	154	149	147	147	146	146
County-Other, Hudspeth	104	92	88	85	84	84	84
County-Other, Jeff Davis	141	132	128	124	122	122	122
County-Other, Presidio	147	137	132	129	129	128	128
County-Other, Terrell	118	107	102	102	102	102	102
East Biggs Water System	67	60	60	60	60	60	60
East Montana Water System	118	109	106	104	103	103	102
El Paso County Tornillo WID	97	89	87	85	83	83	83
El Paso County WCID#4	91	82	78	74	73	72	72
El Paso Water	144	132	128	127	124	122	122
Esperanza Water Service	150	140	136	133	132	131	131
Federal Correctional Institution La Tuna	197	188	185	183	182	182	181
Fort Bliss Water Service	175	164	159	157	157	156	156
Fort Davis WSC	218	209	206	203	201	201	201
Hacienda Del Norte WID	152	143	140	138	137	137	136
Horizon Regional MUD	141	133	131	130	130	130	130
Hudspeth County WCID#1	143	133	129	126	125	124	124
Lajitas Municipal Services	179	170	166	162	160	160	160
Lower Valley Water District	107	96	91	89	88	88	88
Marathon Water Supply & Sewer Service	258	249	245	241	239	239	239
Marfa	249	238	234	231	230	230	230
Paseo Del Este MUD#1	125	116	113	111	110	110	109
Presidio	130	119	116	113	112	112	112
Terrell County WCID#1	194	183	178	178	178	178	178
Van Horn	266	243	239	239	239	239	239

El Paso Water decadal projection is provided by the Utility as illustrated in El Paso Water Strategy E-9 in Appendix 5A. All other utilities in the Plan have acceptable gpcds considering implementation of recommended water management strategies.

5.3.6 Municipal Conservation

El Paso Water (EPW) is the largest supplier of municipal water in Far West Texas, supplying approximately 72 percent of all municipal needs in 2020. The City of El Paso through EPW has been implementing an aggressive water conservation program for the past two decades and has reduced the per capita demand from 200 gpcd in 1990 to a current level of less than 130 gpcd. The overall per capita potable water use for EPW and its wholesale customers, including steam electric and industrial use, was about 130 gpcd in 2013. EPW intends to continue its aggressive water conservation efforts and estimates that demand can be reduced by about 3 gpcd per decade by conservation efforts. The continuation of the conservation effort is a key component of the El Paso Integrated Water Management Strategy discussed in Chapter 5.

El Paso Water maintains a robust conservation website that provides conservation tips, a guide to native plants, a step-by-step guide on how to use your water meter to check for leaks, a water use calculator, and several other topics that focus on conservation. https://www.epwater.org/conservation

El Paso's TecH2O Learning Center has numerous educational exhibits geared towards school-aged students that focus on conservation, groundwater, desalination, xeriscape and several other topics. They maintain a conservation website, provide classroom activities for elementary, middle and high school, and offer Water Smart workshops for the public and for educators. https://www.tech2o.org/

5.3.7 Irrigation Conservation

Irrigation represents approximately 65 percent of all the water used in Far West Texas. Most of this water is diverted from the Rio Grande and is applied to crops on farms located along the Rio Grande floodplain in El Paso, Hudspeth, and Presidio Counties. During significantly dry periods, insufficient water is available in upstream reservoirs to meet the full permitted allotments, and farmers in these areas have generally approached this situation by reducing acreage irrigated, changing types of crops planted, or possibly not planting crops until water becomes available during the following season. In some cases, farmers may benefit from management practices described in Chapter 5, which are a mixture of site-specific management, educational, and physical procedures that have proven to be effective and are cost-effective for conserving water.

The implementation of water conservation programs that are cost effective, meet state mandates, and result in permanent real reductions in water use will be a challenge for the citizens of Far West Texas. Smaller communities that lack financial and technical resources will be particularly challenged and will look to the State for assistance. Irrigation conservation may result in significant reductions in water use. However, without financial and technical assistance, it is unlikely that aggressive irrigation conservation programs will be implemented.

Staff of the Texas AgriLife Research Center at El Paso evaluated the applicability, water savings potential, implementation feasibility, and cost effectiveness of seventeen irrigated agriculture water conservation practices in Far West Texas during both drought and full water supply conditions. Agricultural, hydrologic, engineering, economic, and institutional conditions are identified and examined for the three largest irrigated agricultural areas which account for over 90 percent of total irrigated agricultural acreage in Far West Texas. Factors considered in evaluating conservation strategies included water sources, use, water quality, cropping patterns, current irrigation practices, delivery systems, technological alternatives, market conditions and operational constraints.

The overall conclusion is that very limited opportunities exist for significant additional water conservation in Far West Texas irrigated agriculture. The primary reasons can be summarized by:

- the most effective conservation practices have already been implemented and associated water savings realized throughout the region;
- reduced water quality and the physical nature of gravity flow delivery limit or prohibit implementation of higher efficiency pressurized irrigation systems;
- increased water use efficiency upstream has the net effect of reducing water supplies and production of downstream irrigators; and,
- water conservation implementation costs for many practices exceed the agricultural value and benefits of any water saved.

Those practices that suggest economic efficient additional water conservation included lining or pipelining district canals and the very small potential for additional irrigation scheduling and tail water recovery systems. In nearly all cases, these practices have been adopted if applicable, further emphasizing the very limited opportunities for additional conservation. If these strategies were implemented, the water conserved would satisfy a small percentage of the projected unmet agricultural water demand in 2060 during drought-of-record conditions.

The full report on the irrigation conservation analysis is available at http://www.twdb.texas.gov/publications/reports/contracted_reports/doc/0704830690_RegionE/TxAgriLifeResearchIrrigationEfficiency-FinalReport.pdf.

5.3.8 Manufacturing Conservation

Most groundwater used for manufacturing in El Paso County is for petroleum refining. Refinery water consumption depends primarily on which of three configurations (cracking, light coking, and heavy coking) is utilized. These processes consume 14 to 20 gallons of water per barrel of crude processed.

Water consumption at most refineries includes cooling water evaporation loss, water embedded with product, steam trap losses, steam vent losses firewater main leaks to ground, evaporation f from usage during maintenance, and evaporation from open water ponds in the wastewater treatment plant.

Recent improved practices across the industry include the following:

- Monitoring of steam used to purge and disperse flare tips
- Replacing turbines that vent steam to the atmosphere with non-vented options
- Capturing blowdown water from boilers in lower-pressure drum and cooling before sending to WWTP
- Identifying and minimizing steam leaks
- Rerouting steam traps that vent to ground to condensate recovery headers, and

- Capturing steam lost through top of de-aerators.

5.3.9 Water Loss Audit and Main-line Repair

Reported municipal use generally includes a variable amount of water that does not reach the intended consumer due to water leaks in the distribution lines, unauthorized consumption, storage tank overflows, and other wasteful factors. For some communities, attending to these issues can be a proactive conservation strategy that may result in significant water savings.

To address the lack of information on water loss, the 78th Texas Legislature passed House Bill 3338, which required retail public utilities that provide potable water to perform and file with the TWDB a water audit computing the utility's most recent annual system water loss every five years. In response to the mandate of House Bill 3338, TWDB developed a water audit methodology for utilities to quantify water losses, standardize water loss reporting and help measure water efficiency. This TWDB report 376 titled 'Water Loss Audit Manual for Texas Utilities' can be accessed at: http://www.twdb.texas.gov/conservation/municipal/waterloss/index.asp A summary of the first audit, An Analysis of Water Loss as Reported by Public Water Suppliers – 2007 was provided to the Far West Texas Water Planning Group (FWTWPG) for consideration in developing water supply management strategies. This document can be accessed from the TWDB website in its entirety at:

Volume I - https://www.twdb.texas.gov/publications/reports/contracted_reports/doc/0600010612_WaterLossinTexas.pdf

Volume II - https://www.twdb.texas.gov/publications/reports/contracted_reports/doc/0600010612_waterlossintexas_appendix.pdf

Table 1-2 in Chapter 1, Section 1.9 provides a listing of reported utility audits performed in Far West Texas in 2010.

Water Loss Audit Resources

The TWDB provides a significant amount of information and services pertaining to water loss audit that can be accessed at: https://www.twdb.texas.gov/conservation/resources/waterloss-resources.asp. Additional resources and appropriate forms provided by TWDB include:

Water Audit Worksheet Instructions

Guidelines for Setting a Target Infrastructure Leakage Index (ILL)

Water Loss Manual for Texas Utilities (Updated March 2008)

Main Line Water Loss Calculator

Monthly Water Loss Report

Leak Detection Equipment Loan Form

Ultrasonic Flow Meter Equipment Loan Form

Troubleshooting for Negative Water Loss Audit Components

Over the last few years, smart meters and advanced metering infrastructure (AMI) have become quite popular. AMI meters allow real-time monitoring of water usage. The AMI systems can help pinpoint water loss and allows for more interactive and responsive water management by the water provider. A growing number of cities (including Dallas and Granbury) are requesting SWIFT funding to help with the installation of updated AMI.

5.3.10 Water User Group Conservation Management Plans

In the consideration of regional conservation, the Far West Texas Water Planning Group reviewed active water conservation management plans provided to the planning group by the following entities.

Public Supply Entities

City of Alpine - *Water Conservation Management Plan* http://www.cityofalpine.com/

Dell City – *Water Conservation and Drought Contingency Plan*

El Paso County WCID #4 – *Drought Contingency Plan*

El Paso Water Utilities – *EPWU Water Conservation Management Plan* https://www.epwater.org/

Esperanza Water Service Company – *Drought Contingency Plan*

Fort Bliss WSC – *Water Conservation Management Plan* http://www.asusinc.com

Fort Davis WSC – *Drought Contingency Plan* http://www.fortdavis.com

Fort Davis Estates – *Drought Contingency Plan*

Green Acres/River View Water Works – *Drought Contingency Plan*

Horizon Regional MUD – *Water Conservation Management Plan* http://horizonregional.com/

Lajitas Utility Company – *Drought Contingency Plan*

Lower Valley Water District – *Water Conservation Management Plan* http://www.lvwd.org/

Marfa City Water Works – *Water Conservation Management Plan*

Marathon Water Supply and Sewer Service Corp. – *Drought Contingency Plan*

City of Presidio – *Water Conservation Management Plan* http://presidiotx.us/

City of Sanderson – *Comprehensive Plan* http://www.sandersonchamber.com/

Study Butte WSC – *Drought Contingency Plan*

Terrell County WCID No.1 – *Water Conservation Management Plan* http://www.sandersontx.info/services/tcwcid.html

Turf Water System – *Drought Contingency Plan*

Town of Anthony – *Water Conservation Management Plan* http://www.anthonytx.org/

Town of Valentine – *Drought Contingency Plan*

Town of Van Horn – *Water Conservation and Drought Contingency Plan* https://www.vanhorntexas.org/

Villa Alegre Estates – *Drought Contingency Plan*

Vinton Hills Water System – *Drought Contingency Plan*

Vinton Village Estates – *Drought Contingency Plan*

Village of Vinton – http://www.vintontx.govoffice2.com/

Irrigation Districts

El Paso County Water Improvement District No.1 – *Management Plan* http://www.epcwid1.org/

Hudspeth County Conservation and Reclamation District No.1 – *Management Plan*

5.3.11 Groundwater Conservation Districts Management Plans

The Texas Legislature has established a process for local management of groundwater resources through Groundwater Conservation Districts. The Districts are charged with managing groundwater by providing for the conservation, preservation, protection, recharging and prevention of waste of groundwater within their jurisdictions. An elected board governs these districts and establishes rules, programs and activities specifically designed to address local problems and opportunities. Texas Water Code §36.0015 states, in part, "Groundwater Conservation Districts created as provided by this chapter are the State's preferred method of groundwater management." Six districts are currently in operation within the planning region:

- Brewster County Groundwater Conservation District
- Culberson County Groundwater Conservation District
- Hudspeth County Underground Water Conservation District#1
- Jeff Davis County Underground Water Conservation District
- Presidio County Underground Water Conservation District
- Terrell County Groundwater Conservation District

In recent sessions, the Texas Legislature has redefined the way groundwater is to be managed by Groundwater Management Areas http://www.twdb.texas.gov/groundwater/management_areas/index.asp. The joint planning process is summarized in Chapter 1, Section 1.1.5.

As part of the joint planning process, groundwater conservation districts are responsible for determining the desired future conditions within a management area. Desired future conditions are defined in Title 31, Part 10, §35601. (6) of the Texas Administrative Code as "the desired, quantified condition of groundwater resources (such as water levels, spring flows, or volumes) within a management area at one or more specified future times as defined by participating groundwater conservation districts." Desired future conditions are implemented to help meet the planning goal for the conservation of water that is to be used for future uses. The following link provides information on desired future conditions. http://www.twdb.texas.gov/groundwater/management_areas/DFC.asp.

The Brewster, Culberson, Hudspeth, Jeff Davis and Presidio districts are in GMA 4. Terrell County Groundwater Conservation District is in GMA 7. As of August 13, 2010, *desired future conditions* have been adopted for the following aquifers: Capitan Reef, Edwards Trinity, Marathon, Rustler, Igneous, Upper Salt Basin, Bone Springs-Victorio Peak, West Texas Bolsons and Presidio-Redford Bolson.

5.3.11.1 Brewster County Groundwater Conservation District

The Brewster County Groundwater Conservation District (http://westtexasgroundwater.com/) was confirmed in 2001 and serves all of Brewster County, the largest county in the State. The mission of the District is to manage, protect, and conserve the groundwater resources of Brewster County, while protecting private property rights and promoting constructive and sustainable development in the county. The table below presents the adopted DFCs for the aquifers in Brewster County. The approved 2015 Management Plan is available here.

Adopted Desired Future Conditions for Brewster County

Aquifer	Capitan Reef Complex	Edwards-Trinity (Plateau)	Igneous	Marathon	Rustler
DFC	0-foot drawdown	3-foot drawdown	10-foot drawdown	0-foot drawdown	Aquifer non-relevant

5.3.11.2 Culberson County Groundwater Conservation District

The Culberson County Groundwater Conservation District was confirmed in May 1998 and occupies the southwestern half of Culberson County. Aquifers managed by the District primarily include the Wild Horse Flat, Michigan Flat, and Lobo Flat of the West Texas Bolsons, and the Capitan Reef. The table below presents the adopted DFCs for the aquifers in Culberson County. The approved 2019 Management Plan can be accessed at: http://www.twdb.texas.gov/groundwater/docs/GCD/culbersoncgcd/culbersoncgcd_mgmt_plan2014.pdf.

Adopted Desired Future Conditions for Culberson County

Aquifer	Capitan Reef Complex	Edwards-Trinity (Plateau)	Igneous	West Texas Bolsons	Upper Salt Basin
DFC	50-foot drawdown	Aquifer non-relevant	66-foot drawdown	78-foot drawdown	Aquifer non-relevant

5.3.11.3 Hudspeth County Underground Water Conservation District #1

The Hudspeth County Underground Water Conservation District #1 was created in 1956 and is in the Dell Valley irrigation area of northeast Hudspeth County, with the Community of Dell City lying approximately in the center of the District. The principal aquifer in the District is the Bone Spring-Victorio Peak. The District recently installed eight continuous water-level recorders and has placed flow gauges on irrigation wells. The table presents the adopted DFCs for the aquifer in Hudspeth County. The latest District management plan adopted in May of 2013October of 2018 can be accessed here.

Adopted Desired Future Conditions for Hudspeth County

Aquifer	Bone Spring – Victorio Peak	Capitan Reef Complex
DFC	0-foot drawdown	Aquifer non-relevant

5.3.11.4 Jeff Davis County Underground Water Conservation District

The Jeff Davis County Underground Water Conservation District was formed in August 1994 (HB 2866) and includes all of Jeff Davis County. Primary aquifers managed by the District include the Ryan Flat and Lobo Flat of the West Texas Bolsons and the Davis Mountains Igneous. District activities include the registration of all new wells and the permitting of wells that can produce 25,000 gallons per day or more. State well-construction standards are enforced, and water levels are monitored in 28 observation wells located in high use areas. The District is involved in a wellhead protection program with the Fort Davis Water Supply Corp. and provides educational programs for schools and the public. The table presents the adopted DFCs for the aquifers in Jeff Davis County. The latest District management plan adopted in 2019 can be accessed here.

Adopted Desired Future Conditions for Jeff Davis County

Aquifer	Edwards-Trinity (Plateau)	Igneous	West Texas Bolsons	Pecos Valley	Capitan Reef Complex	Rustler
DFC	Aquifer non-relevant	20-foot drawdown	72-foot drawdown	Aquifer non-relevant	Aquifer non-relevant	Aquifer non-relevant

5.3.11.5 Presidio County Underground Water Conservation District

Presidio County residents approved the formation of the Presidio County Underground Water Conservation District in an election held August 31, 1999. Primary aquifers to be managed in the District include the Presidio-Redford Bolson, the Ryan Flat West Texas Bolson, and the Davis Mountains Igneous. District activities include well permitting, recharge enhancement, and public education. The table presents the adopted DFCs for the aquifers in Presidio County. The latest District management plan adopted in January of 2015 can be accessed here. .

Adopted Desired Future Conditions for Presidio County

Aquifer	Igneous	Presidio – Redford Bolsons	West Texas Bolsons
DFC	14-foot drawdown	72-foot drawdown	72-foot drawdown

5.3.11.6 Terrell County Groundwater Conservation District

The creation of the Terrell County Groundwater Conservation District was approved and confirmed by the voters of Terrell County at the confirmation election held on November 6, 2012. The Edwards-Trinity (Plateau) Aquifer is the primary aquifer managed by the district. The district accomplishes its objectives by working to lessen interference between water wells, minimize drawdown of groundwater levels, prevent the waste of groundwater, and reduce the degradation of groundwater quality. The District is focused on helping the local economy maintain and improve its current condition. District activities include the protection of existing wells, permitting of new wells and public education. The table presents the adopted DFCs for the aquifer in Terrell County. The approved management plan adopted October 2018 can be accessed here.

Adopted Desired Future Conditions for Terrell County

Aquifer	Edwards-Trinity (Plateau)
DFC	2-foot drawdown

APPENDIX 5A
RECOMMENDED AND ALTERNATE WATER MANAGEMENT STRATEGIES

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INTRODUCTION

"A water management strategy is a plan to meet an identified water need for additional water by an entity, which can mean increasing the total water supply or maximizing an existing supply, including through reducing demand. When a water management strategy project is implemented, it is intended to develop, deliver, and/or treat additional water supply volumes, or conserve water for an entity" (TWDB-Exhibit C General Guidelines-April 2018). The Far West Texas Regional Water Planning Group has identified and evaluated a total of 58 water management strategies. Of this total, 10 are "Alternate" strategies, which can be substituted for "Recommended" strategies that are later determined to be non-viable.

Water management strategies described in this appendix are proposed recommended and alternate projects to meet projected water supply shortages in future decades, and projects of specific interest by water-user entities participating in this planning process. Section 5.2 of this chapter provides an explanation of the strategy evaluation procedure and Tables 5-2, 5-3, and 5-4 provide a side-by-side comparison such that all strategies can be assessed based on the same quantifiable factors.

<u>Table 5-2</u>

- Quantity of new water produced
- Chemical quality
- Reliability of supply
- Impacts to water, agricultural, and natural resources, and to ecologically unique stream segments

<u>Table 5-3</u>

- Financial cost (total capital cost, annual cost, and cost per acre-foot)

<u>Table 5-4</u>

- Environmental impacts
    - Environmental water needs
    - Wildlife habitat
    - Cultural resources
    - Environmental water quality
    - Inflows to bays and estuaries

Water management strategies recommended for this *2021 Plan* include specific projects or programs related to conservation and reuse, water-loss audit and main-line repair for entities with more than a reported 10-percent water loss, and projects requiring infrastructure construction, upgrades or modifications.

5A-1 WATER MANAGEMENT STRATEGIES FOR BREWSTER COUNTY

5A-1.1 MANAGEMENT STRATEGIES FOR CITY OF ALPINE

The City of Alpine relies on groundwater from the Davis Mountains Igneous Aquifer, which is significantly impacted by local pumping during drought years. The following two strategies are intended to:

1. Utilize all available water (rainwater runoff and treated effluent) for restoration of Alpine Creek, which will improve wildlife habitat, and increase outdoor recreation in the area;
2. To develop a water source that is available to recharge the underlying aquifer system (ASR);
3. To diminish the amount of treated groundwater that is currently used for landscape irrigation;
4. To provide for more reuse-efficient landscape irrigation of the Country Club golf course, baseball fields, Kokernot Park (pool and picnic areas), and Poets Grove.

- (E-1) Modification to wastewater treatment facility & irrigation system
- (E-2) Irrigation and recharge application of captured rainwater runoff

E-1 Modification to Wastewater Treatment Facility & Irrigation System

The City of Alpine Wastewater Treatment Plant receives up to 400,000 gallons per day and discharges 75,000 gallons per day. Currently the WWTP treated effluent can irrigate the north section of the *project area* (Golf Course) from a 35,000-gallon surface storage tank. This strategy project will increase the availability of non-potable water and thus reduce the demand for fresh water. The project includes modifications to the WWTP, installation of an additional 50,000-gallon storage tank (for a total of 85,000-gallon storage capacity) and extension of the main transmission pipeline to supply additional irrigation to the south side of the Golf Course.

Beneficial biproducts of this project (but not a part of the strategy project) include a proposed irrigation system to use the additional treated effluent to irrigate around the baseball fields, Kokernot Park (pool, picnic areas), and Poets Grove, all located in the pilot project area. This would allow the City to efficiently reuse all the treated effluent available for irrigation, with any surplus supplied to Alpine Creek, enhancing bird habitat by establishing native trees and vegetation as well as providing a water feature for a nature trail along the creek between the golf course and the loop road. A hydrological analysis will explore the possibility of additionally using some of the treated effluent for Aquifer Storage Recovery (ASR). The City will submit an amendment to the TCEQ Wastewater permit (WQ0014349001) to include the proposed plan to reuse 100 percent of the treated effluent.

Quantity, Reliability and Cost - The project will allow the City to use 100 percent of treated wastewater discharge, an increase of 30 percent or 25 acre-feet per year to irrigate project properties that were previously irrigated with fresh water. The project is planned for completion and delivery of water by the start of the 2030 decade and the estimated capital cost of infrastructure modification and irrigation system is $2,318,000.

E-2 Irrigation and Recharge Application of Captured Rainwater Runoff

In a good year, the City of Alpine receives approximately 17 inches of rain, much of which is lost to runoff. High-intensity thunderstorms contribute to greater runoff into nearby Alpine Creek, causing higher peak flooding. This prevents the creek from functioning properly as evidenced by the scoured, cut and straightened channel that exists today which must be armored with engineered banks. Additionally, runoff transports pollutants into the creek, which eventually flows into the Rio Grande. As with many towns in West Texas, the streets act as a storm water drainage system. These water catchments take that liability and turn it into an asset.

This strategy proposes constructing rainwater catchment basins at three locations around Kokernot Park, which will drain neighboring streets. Impounding a large volume of water from the roads will allow the captured water time to infiltrate the soil, recharge the underlying aquifer, and remediate pollutants. These basins will also be landscaped with water-efficient plants without tapping into the city's aquifer water for irrigation. These catchments will also demonstrate how residents can reduce water use and cost by capturing rainwater and landscaping with water-efficient native plants. This project will also help reduce down-stream flooding.

Quantity, Reliability and Cost - The three catchment basins (approximately 70 acres in combined size) are calculated to capture approximately 70 acre-feet during an average drought (12 inches or 75% of average annual rainfall) year. The project is planned for construction within the 2030 decade and come online prior to 2030. The estimated capital cost to construct the thee catchment basins and retention dams is $1,296,000.

5A-1.2 MANAGEMENT STRATEGIES FOR BREWSTER COUNTY - OTHER

Although the supply-demand analysis (Chapter 4) does not project a future water supply deficit for Brewster County Other, the following water management strategies are recommended to enhance the reliability of the future water supply availability for rural and small-town residents within Brewster County:

- (E-3) Marathon Water Supply & Sewer Service Co. - Water loss audit and main-line repair
- (E-4) Lajitas Municipal Services - Water loss audit and main-line repair
- (E-5) Study Butte Terlingua WS - Water loss audit and main-line repair

E-3 Marathon Water Supply & Sewer Service Company - Water Loss Audit and Main-line Repair

According to the 2016 TWDB Public Water System Water Loss Survey, the Marathon Water Supply & Sewer Service Company had real water losses (as opposed to apparent "paper" losses) of 19 acre-feet in 2016 (19.6%) due to leaking infrastructure. This amount of water loss is the sum of reported breaks and leaks, and unreported loss. The water supply system can reduce water losses and get a more accurate look at water consumption by taking the proper measures to identify and repair old infrastructure and inaccurate water meters. This strategy will provide a savings of only a portion of the total reported loss and assumes that a leak testing program would be implemented prior to possibly replacing portions of the existing leaking pipe.

Quantity, Reliability and Cost - The strategy assumes 1 mile of 6-inch diameter pipe will be replaced, at a total estimated project capital cost of $255,000. The strategy is estimated to generate a potential savings of 12 acre-feet of water per year throughout the planning period.

E-4 Lajitas Municipal Services - Water Loss Audit and Main-line Repair

According to the 2016 TWDB Public Water System Water Loss Survey, the Lajitas Municipal Services Company had real water losses (as opposed to apparent "paper" losses) of 98 acre-feet in 2016 (59.3%) due to leaking infrastructure. This amount of water loss is the sum of reported breaks and leaks, and unreported loss. The water supply system can reduce water losses and get a more accurate look at water consumption by taking the proper measures to identify and repair old infrastructure and inaccurate water meters. This strategy will provide a savings of only a portion of the total reported loss and assumes that a leak testing program would be implemented prior to possibly replacing portions of the existing leaking pipe.

Quantity, Reliability and Cost - The strategy assumes 10 miles of 6-inch diameter pipe will be replaced, at a total estimated project capital cost of $2,545,000. The strategy is estimated to generate a potential savings of 51 acre-feet of water per year throughout the planning period.

E-5 Study Butte Terlingua Water System - Water Loss Audit and Main-line Repair

According to the 2015 TWDB Public Water System Water Loss Survey, the Study Butte Water Supply Corporation, the Terlingua water utility, had real water losses (as opposed to apparent "paper" losses) of 31 acre-feet in 2015 (50.5%) due to leaking infrastructure. This amount of water loss is the sum of reported breaks and leaks, and unreported loss. The water supply system can reduce water losses and get a more accurate look at water consumption by taking the proper measures to identify and repair old infrastructure and inaccurate water meters. This strategy will provide a savings of only a portion of the total reported loss and assumes that a leak testing program would be implemented prior to possibly replacing portions of the existing leaking pipe.

Quantity, Reliability and Cost - The strategy assumes 12 miles of 6-inch diameter pipe will be replaced, at a total estimated project capital cost of $3,054,000. The strategy is estimated to generate a potential savings of 25 acre-feet of water per year throughout the planning period. The Study Butte Terlingua Water System is not an official Water User Group for regional water planning purposes, so demand projections were not developed specifically for them but are accounted for under Brewster County-Other by TWDB. The potential savings identified in this strategy are based the amount used in 2015.

5A-2 WATER MANAGEMENT STRATEGIES FOR CULBERSON COUNTY

5A-2.1 WATER MANAGEMENT STRATEGIES FOR CULBERSON COUNTY IRRIGATION

Culberson County has a water supply deficit for irrigation use projected at 333 acre-feet per year in 2020 and in 2030. The following water management strategies are recommended to enhance the reliability of the future water supply availability for the irrigation water supply shortages within Culberson County:

- (E-6) Irrigation Scheduling
- (E-7) Additional well in the West Texas Bolsons Aquifer (Upper Salt Basin)

E-6 Irrigation Scheduling

This strategy is intended for producers with an adequate supply of water throughout the growing season. It involves scheduling the time and amount of water that is applied to a crop based on the amount of water present in the crop root zone, the amount of water consumed by the crop since the last irrigation, and other considerations. Water savings are difficult to quantify and vary from year to year based on cropping practices, water quality, and quantity. It is estimated that 0.3 to 0.5 acre-feet of water per acre may be saved. (Modified from TWDB BMPs at: http://www.twdb.texas.gov/conservation/BMPs/Ag/index.asp)

Quantity, Reliability and Cost - According to the 2017 U.S. Ag Census, Culberson County had sixteen farms with irrigated land in 2017 and 5,730 acres of irrigated land, which gives an average of 358 acres per farm using the process described below, and assuming that scheduling would conserve 0.3 acre-feet per acre, this results in a conservation savings of approximately 107 acre-feet per farm. The reliability of this supply is low due to uncertainty associated with estimated implementation of BMPs. There is no capital cost associated with implementing this strategy.

E-7 Additional Well in the West Texas Bolsons Aquifer (Upper Salt Basin)

This strategy assumes that one new well will need to be drilled to approximately 400 feet below the surface. Historical agriculture use indicates that the Upper Salt Basin aquifer is a viable source. The Upper Salt Basin Aquifer is the northern most aquifer of the West Texas Bolsons Aquifer System and is a potential source of water to meet irrigation supply shortages within Culberson County. Groundwater within the Upper Salt Basin varies from fresh to moderately saline ranging between 1,000 and 4,000 milligrams per liter of total dissolved solids.

Quantity, Reliability, and Cost - One new well is assumed to supply 333 acre-feet per year. The reliability of this supply is medium to high, based on competing demands. The total capital cost of this project is approximately $510,000.

5A-3 WATER MANAGEMENT STRATEGIES FOR EL PASO COUNTY

5A-3.1 WATER MANAGEMENT STRATEGIES FOR THE TOWN OF ANTHONY

The Town of Anthony and many other residents of El Paso County rely on the Hueco-Mesilla Bolson Aquifer for municipal, domestic, livestock, and irrigation water supply needs. The Town's population is projected to increase from 4,206 in 2020 to 8,052 by 2070. As the population increases, water demands increase. This creates a significant amount of strain on the Hueco-Mesilla Bolson Aquifer. Continued withdrawals from the Aquifer may negatively impact the Aquifer's ability to meet the long-term water supply needs of the area.

The Town of Anthony does not have a projected water supply deficit this planning cycle. The following water management strategies are recommended to enhance the reliability of the City's future water supply availability:

- (E-8) Arsenic treatment facility
- (E-9) Additional groundwater well

The City of Anthony is currently being funded for a wholesale water treatment plant replacement and expansion through the TWDB's Clean Water State Revolving Fund (CWSRF).

E-8 Arsenic Treatment Facility

Naturally occurring arsenic is found in the groundwater relied upon by the residents of the Town of Anthony. The community's groundwater supply from the Mesilla Bolson Aquifer hovers around the maximum contaminant limit of 10 ppb. Aided by financial assistance from the TWDB, utilizing the Drinking Water State Revolving Fund, the Town has plans to install an arsenic treatment system to meet the State's water supply and public safety standards.

Capital cost is derived from taking the total project cost reported in the 2019 TWDB Drinking Water State Revolving Fund Intended Use Plan ($7,449,947) and incorporating it into the TWDB Costing Tool to add contingencies and develop annual costs.

Quantity, Reliability, and Cost - The new arsenic treatment facility is assumed to supply 2,800 acre-feet per year of potable water. Reliability of the project is high since the Mesilla Bolson Aquifer has historically been found as a reliable source. The total capital cost for this project is estimated to be $10,334,000.

E-9 Additional Groundwater Well

Due to ongoing drought resulting in lower aquifer water levels and condition of existing wells because of age, the Town of Anthony has experienced a decrease in water production from their three existing municipal water wells. Additionally, one of the three wells has been taken out of service. Preliminary inspection of the well shows that the casing is corroded and fractured allowing sand to enter and fill the well screen. The Town is pursuing rehabilitation of this well. However, based on existing and future water demands, in addition to the condition of the Town's existing wells, a new municipal water well is required to reliably supply additional water. Anticipated depth of the well is 800 feet and a capacity of 1,200 GPM.

Quantity, Reliability and Cost – The well is anticipated to reliably provide an additional supply of 960 acre-feet per year from the Mesilla Bolson Aquifer, even though some long-term water level decline can be expected. According to Parkhill Smith & Cooper (project engineers), the estimated budget cost of a new well for the Town of Anthony is $1,913,000.

5A-4 EL PASO WATER INTEGRATED STRATEGIES

El Paso Water (EPW) is the City's municipal water-supply utility as well as wholesale water-supply provider for several other municipal entities and industries. EPW supply sources include both surface water (Rio Grande) and groundwater (Hueco and Mesilla Bolson aquifers), which are managed in an "integrated" approach that balances each source's availability throughout the year. EPW further manages these primary sources with innovative approaches including advanced purification treatment, reuse of previously used water, and desalination of brackish groundwater. And of critical importance, the various management practices are all preceded by one of the state's most successful conservation programs.

The projected demand for water provided by EPW, including the City of El Paso and all wholesale clients, is projected to increase from 137,479 acre-feet per year in 2020 to 198,364 acre-feet per year in 2070. With current infrastructure and supply availability, EPW is projected to see a need for the development of additional supplies by the 2030 decade, which will increase to approximately 58,498 acre-feet per year by 2070.

To meet the future need for additional water supply, EPW continues to update its *Integrated Water Management Plan*. The Plan involves the design of new project strategies to be implemented at appropriate time periods to ensure that EPW maintains sufficient water supplies in advance of projected need. The *Integrated Water Management Plan* evolved from an analysis of integrated water-development strategies for the City and County of El Paso in the *2006 Far West Texas Water Plan*, which was subsequently updated in the *2011 and 2016 Plans*. The strategies considered are termed "integrated" because they represent combinations of individual sources due to the unique nature of water management in El Paso. Taken separately, each source can be evaluated and analyzed. However, combining all sources into an integrated strategy provides an opportunity to evaluate the interrelationship of the individual components and provides a regional context to the *Regional Plan*. For this *2021 Far West Texas Plan*, the recommended Integrated Water Management Strategy in the *2016 Plan* has again been updated and several new component strategies have been added. The recommended Integrated Strategy adopted to meet the needs for additional water supply for EPW is comprised of the following individual projects listed below. The first five strategies are "recommended" to meet EPW's future demand needs, while the remaining nine are considered as "alternate" strategies available to be considered if any of the "recommended" strategies fail to fully meet future projected needs.

EPW Integrated Water Management Strategies

Strategy Number	Strategy Name
Recommended Strategies	
E-10	Municipal conservation programs
E-11	Advanced water purification at the Bustamante WWTP
E-14	Hueco Bolson Artificial Recharge
E-16	Groundwater from Dell City area (Phase 1)
E-17	Groundwater from Dell City area (Phase 2)
Alternate Strategies	
E-12	Advanced water purification at the Haskell WWTP
E-13	Expansion of the Kay Bailey Hutchison Desal Plant
E-15	Riverside regulating reservoir
E-18	Treatment and reuse of agricultural drain water
E-19	Expansion of Canutillo Mesilla Bolson wellfield
E-20	Lower Valley wellhead RO
E-21	Expansion of Jonathan Rogers WTP
E-22	Conjunctive treatment of groundwater and surface water at the Upper Valley WWTP
E-23	Advanced water purification at the Fred Hervey WWTP

E-10 Municipal Conservation Programs

Reduction of municipal water consumption may be achieved with the implementation of conservation programs that reduce per capita usage and prevent water waste. El Paso Water (EPW) has been implementing an aggressive water conservation program for nearly 30 years with actions such as adoption of a rate structure that penalizes high consumption, restrictions on residential watering, rebate programs for replacing appliances and bathroom fixtures for low consumption units, plumbing fixtures to reduce leaks, native landscaping programs to reduce landscape irrigation, public education, control of water losses, and enforcement.

Since 1990, the City has had a water conservation department with at least seven full time staff members overseen by a Water Conservation Manager (for a total of eight full time staff members). The department develops and oversees the City’s conservation program, collects data, provides enforcement, and develops public outreach programs.

Reuse is an important component of EPW’s water-supply management program. The City currently has a ‘purple pipe’ water reuse program that provides treated wastewater for irrigation of golf courses, city parks, school grounds, and apartment landscapes, construction and industrial use, as well as indirect reuse by using treated wastewater for artificial recharge. The City is also in the process of implementing a direct reuse strategy, which is evaluated separately.

EPW’s water conservation efforts have reduced per capita municipal use in El Paso from about 225 gallons per capita per day (gpcd) in the late 1970s to a current level of 128 gpcd. Residential per capita consumption was 72 gpcd in 2018. The overall per capita potable water use for EPW and its wholesale customers, including steam electric and industrial use, was about 128 gpcd in 2018. This strategy assumes the continuation of EPW’s aggressive water conservation efforts and estimates that demand can be reduced by conservation efforts to approximately 112 gpcd by 2070.

Quantity, Reliability, and Cost – The table below presents the additional supplies that would result from this strategy's projected level of conservation.

Projected Conservation Supply (Acre-Feet)

	2020	2030	2040	2050	2060	2070
Projected Population Served by El Paso Water WUG	734,031	822,625	904,900	986,455	1,063,672	1,136,275
TWDB Projected gpcd[1]	134	131	128	127	126	126
EPW Expected gpcd[2]	128	125	123	118	115	112
Savings above TWDB Projections (acre-feet/year)	**4,950**	**5,530**	**5,080**	**9,940**	**13,140**	**17,820**

1. TWDB Project gpcd includes savings from plumbing code
2. Expected gpcd goals are based on conversations with EPW and are equal to or lower than the 2019 Water Conservation Plan (WCP) goals

Projected Cost of El Paso Water Utilities Conservation Strategy

	2020	2030	2040	2050	2060	2070
Annual Cost	$1,071,000	$1,071,000	$1,071,000	$1,071,000	$1,071,000	$1,071,000
Cost per Acre-Foot	$216	$194	$211	$108	$82	$60
Cost per 1,000 gallons	$0.66	$0.59	$0.65	$0.33	$0.25	$0.18

EPW has successfully reduced per capita demands resulting in considerable water savings. Water demand projections prepared by TWDB already account for water efficiency savings through time due primarily to plumbing code savings. The savings reported in the Table above are the result of "active" water conservation strategies that conserve water above and beyond what would happen anyway as a result of "passive" water conservation measures that stem from federal and state legislation requiring more efficient plumbing fixtures in new building construction. The trend in expected gpcd is consistent with EPW's 2019 Water Conservation Plan (WCP) through the 2040 decade. Beginning in 2050, the gpcd goals are lower than the goals laid out in the 2019 WCP.

EPW budgeted $1,071,000 for water conservation programs in their annual budget for fiscal year 2019-2020. Because of the importance of conservation, it was assumed that EPW will invest a similar amount in conservation over the planning period. The projects annual costs for water conservation are shown in the table above.

E-11 Advanced Water Purification at the Bustamante WWTP

The Roberto R. Bustamante Wastewater Treatment Plant (Bustamante WWTP) is located in southern El Paso near the community of Socorro. The plant is adjacent to the Jonathan Rogers Water Treatment Plant and the Rio Bosque wetlands. The wastewater plant currently discharges approximately 27 million gallons per day (MGD) into the Riverside Irrigation canal and 1.5 MGD to reclaimed water "purple pipe" customers as part of the Mission Valley Reclaimed Water Project.

The Bustamante Advanced Water Purification strategy has been studied in detail by Arcadis and Carollo Engineers. Project components recommended by Arcadis include additional conventional wastewater treatment at the existing plant to remove nutrients, an advanced treatment facility (microfiltration/ultrafiltration, nanofiltration or reverse osmosis, ultraviolet/advanced oxidation process, activated carbon and chlorine disinfection) and storage. The purified water will be placed directly into the distribution system.

Carollo estimated that the amount treated by the advanced treatment facility would be 10.7 MGD initially and increase to 13.3 MGD at build-out. Approximately 70% of this influent would become finished drinking water. For this evaluation, disposal of the waste stream was assumed to be by deep well injection and to be approximately 30% of the amount treated. Construction costs and annual operation and maintenance costs for the Advanced Water Treatment Facility (AWTF) were based on a 2019 cost estimate by Carollo Engineers. Construction costs for the additional wastewater treatment plant improvements and for conveyance from the Bustamante WWTP to the AWTF were based on a 2014 cost estimate by Arcadis and indexed up to 2018 costs. For this evaluation, costs were added for the necessary connection piping to the distribution system and the disposal well system.

Currently, most of the wastewater from the Bustamante WWTP that is not being reused is discharged into a canal system. Much of that water is then used for downstream irrigation, although some of the flow may also serve to maintain environmental functions. Reuse of additional water may impact those functions, but the overall impact is expected to be small. The current conceptual design for this project uses deep well injection to dispose of the brine waste stream, which should have minimal environmental impact. If this was to change and the brine was released to a stream, impacts to the receiving water body would need to be evaluated.

The Advanced Water Purification strategy will treat only part of the effluent from the Bustamante WWTP. EPW will continue to meet its contractual obligations to purple pipe customers and to provide a portion of the wastewater that originates as surface water for downstream irrigators. There may be other impacts from reducing the amount of wastewater that is not covered by contractual obligations.

It is anticipated that this strategy will be implemented by 2030. After reviewing data from a pilot facility, the Texas Commission on Environmental Quality (TCEQ) gave EPW approval to proceed with design of the of the full-scale facility. EPW officials hope to break ground on the Advanced Water Treatment Facility in the next few years and supply their customers with reclaimed water within 10 years.

This project is part of EPW's Integrated Water Strategy and is inherently related to other EPW strategies and sources of supply. The availability of water from this strategy is affected by the portion of the treated effluent that originates as surface water, a portion of which is dedicated by contract to downstream irrigators. There may be some reduction in return flows that EPW is not obligated to discharge, but this impact is expected to be small.

Quantity, Reliability, and Cost – Based on estimates from Carollo, this strategy would initially provide approximately 8,500 acre-feet per year in 2020, stepping up by 2 MGD per decade, and expanding to approximately 10,600 acre-feet per year by 2070. Because of the quantity of wastewater treated at the plant, the supply should be very reliable, even after accounting for the portion of the supply committed to irrigators and purple pipe customers. The capital cost for this strategy is estimated at $100.4 million.

E-12 Advanced Water Purification at the Haskell Street WRP (ALTERNATE)

The Haskell R. Street Wastewater Treatment Plant (WRP) is located in south central El Paso on the Rio Grande and has a capacity of 27.7 MGD. A portion of the treated wastewater effluent from this plant is the source for the Central Reclaimed Water Project (purple pipe reuse), which is used to irrigate several central El Paso schools and parks, including Ascarete Park and Golf Course. Currently most of the remaining effluent from the Haskell Plant is discharged into either the American Canal, which may then be used for irrigation downstream, or the Rio Grande.

This strategy is assumed to treat additional wastewater effluent to potable safe drinking water standards. The purified water would flow directly into the EPW distribution system, while the remaining brine will be disposed by deep-well injection. EPW will continue to meet its contractual obligations to provide a portion of the wastewater that originates as surface water for downstream irrigators. It is anticipated that this strategy will be implemented in the 2070 decade.

The conceptual design and cost for the strategy were based on the Bustamante Advanced Purified Water Plant. The Haskell R. Street WRP Advanced Water Purification strategy includes additional conventional wastewater treatment at the existing plant to remove nutrients, and advanced treatment facility (microfiltration/ultrafiltration, nanofiltration or reverse osmosis, ultraviolet/advanced oxidation process, activated carbon and chlorine disinfection). Disposal wells and pump stations, assumed to be 30% of the amount treated, were added to expansion phases as needed. The purified water will be placed directly into the public supply distribution system.

Quantity, Reliability, and Cost – For this strategy analysis, it is assumed that the initial capacity of the project would be approximately 12 MGD, with the project on-line in 2070. Assuming a peaking factor of 1.5, this would provide a supply of approximately 8,900 acre-feet per year. The capital cost to build the project is approximately $ 279,464,000.

E-13 Expansion of the Kay Bailey Hutchison Desalination Plant (ALTERNATE)

The Kay Bailey Hutchison Desalination Plant is one of the world's largest inland desalination facilities. The facility is a joint project of El Paso Water (EPW) and Fort Bliss and currently has the capacity to treat 27.5 MGD of brackish groundwater. Disposal of brine reject from the facility is through deep well injection. The project not only provides a safe and reliable supply for the City of El Paso and Fort Bliss, but it also protects fresh groundwater supplies by intercepting the flow of brackish groundwater toward the freshwater wells.

This strategy would expand both the production of brackish groundwater and increase the capacity of the plant by 5.0 MGD for a total of 32.5 MGD. This will involve expanding the existing facility, adding four new source wells and associated piping. For planning purposes, it is assumed that this strategy will be implemented in a single phase. It is assumed that EPW's current disposal facilities are adequate for the project. It is anticipated that this strategy will be producing new water in the 2060 decade.

Quantity, Reliability, and Cost – This project will provide additional water supply in EPW's conjunctive use portfolio. The combination of new wells and another 5.0 MGD of capacity will provide approximately 5,000 acre-feet of water per year. This supply is assumed to be very reliable. The project is expected to cost approximately $26,490,000.

E-14 Hueco Bolson Artificial Recharge

Water treatment plant capacity and the timing of demand for water currently limit the use of surface water by EPW. Early in the irrigation season, the water available from the Rio Grande exceeds the demand that can be supplied by surface water. Later in the irrigation season, the demand can exceed the treatment plant capacity. In order to make use of the available surface water early in the irrigation season, EPW plans to develop a facility to recharge the Hueco Bolson Aquifer with treated surface water.

The Hueco Bolson Aquifer is the primary source of water for the City of El Paso, Fort Bliss, Ciudad Juarez and private industries in the area. Since 1903 groundwater levels have declined by as much as 150 feet in some areas of the Aquifer, thus developing a cone-of-depression around a major pumping center serving the City of El Paso. This area is located over an ancient watercourse of the Rio Grande and is well suited for both short- and long-term groundwater storage due to the high porosity and permeability of the de-saturated vertical portion of the Aquifer formation. The substantial depression in the water table surface thus affords ample underground storage space and reasonably high assurances of long-term recovery of stored water. The recharge basin area described in this strategy is in the northern portion of the cone-of-depression and water percolating downward through the basins will naturally gravity drain in the subsurface toward the existing production wells located approximately two miles away.

Previous projects and studies have shown the practicality of aquifer recharge in the El Paso area. The Hueco Bolson Aquifer has been successfully recharged with tertiary treated wastewater from the Fred Hervey Water Reclamation Plant that is treated to drinking water quality standards. Injection rates of up to about 10,000 acre-feet per year through deep injection wells and spreading basins have occurred since the mid-1980s. Aquifer recharge using both treated wastewater effluent and available surface water provide an opportunity to mitigate aquifer overdraft and potentially restore groundwater supplies for continued use.

The treated water strategy will expand the artificial-recharge basins and supplement the recharge supply with excess treated water from the Jonathan Rogers WTP, and does not include expansion of the Fred Hervey Plant. This strategy will require approximately 10,000 feet of 20-inch pipe and six new spreader basins for the treated water. It is anticipated that this strategy will be producing water in the 2030 decade.

Quantity, Reliability, and Cost - This strategy is estimated to provide 5,000 acre-feet of additional supply per year from the Hueco Bolson aquifer; however, the supply is contingent on surface water supplies availability. Capital costs for this project is approximately $38,003,000.

E-15 Riverside Regulating Reservoir (ALTERNATE)

In order to make more efficient use of surface water supplies, EPCWCID#1 has purchased the City of El Paso former Socorro Pond Sewage Treatment Facility located in the city limits of El Paso near the Bustamante Wastewater Facility. The project will then be developed into the Riverside Regulating Reservoir with project water and cost shared equally between EPW and the EPCWCID#1

The regulating reservoir will allow more efficient use of stored water releases from the Rio Grande Project storage reservoirs, as well as flows that originate as stormwater runoff below Caballo Reservoir. The primary source of water stored in the reservoir would be from excess flows diverted at American Dam and conveyed to the heading of the Riverside Canal. These excess flows primarily consist of storm runoff and operation spills from upstream water users. The temporary stored water would be used either by downstream irrigators or be pumped to the nearby Jonathan Rogers Water Treatment Plant for municipal use. All Rio Grande water is authorized through existing state and federal contracts, agreements and water rights.

The primary benefits of the project are: (1) Improved farm delivery scheduling and flows; (2) Conservation of water stored in upstream storage reservoir through using water captured in regulating reservoirs to meet downstream demands; and (3) A five-day supply of raw water for use by City of El Paso in case of an emergency such as failure or contamination of the American Canal system.

Portions of the project have already been completed, including improvements to the Riverside Franklin Feeder Check Structure; a concreate bridge to the Jonathan Rogers WTP; canal lining; and a flood waste-way to the river.

EPCWID#1 is collaborating with municipalities in El Paso County to make capacity upgrades to existing irrigation drain infrastructure to mitigate flooding while facilitating the capture and reuse of stormwater from local storm events. Stormwater capture and reuse would lead to the development of a new water source for EPCWID#1. Additional studies are needed to determine the quantity and quality of the stormwater that can be captured and the upgrades that are necessary for reuse. EPCWID#1 intends to pursue a mixture of funding options to develop stormwater capture and reuse infrastructure, such as any programs resulting from flood-related legislation passed by the 86th Texas Legislature, including Senate Bill (SB)7, SB 8, SB 500, and House Joint Resolution 4. While the project through EPCWCID#1 (Strategy E-43) is scheduled to come online in the 2020 decade, EPW does not intend to draw water from the project until the 2040 decade.

Quantity, Reliability, and Cost - The primary benefit of this strategy is allowing for more efficient use of existing supplies of water. Previous studies of this project have estimated that the project could provide 6,500 acre-feet of water per year. However, there may be some years where the strategy could provide more or less water, depending on available river supplies and the amount of excess water in the canal. The total capital cost of approximately $13.5 million and supply of 6,500 acre-feet developed from this project is equally split between EPW and the EPCWID#1 ($6,750,000 and 3,250 acre-feet per year each). The strategy supply for EPW is anticipated to come online in 2040.

E-16 Groundwater from Dell City Area (Phase I)

Importation of groundwater from the Dell City area has been part of the Far West Texas Water Plan since 2006. This strategy includes obtaining water rights through the purchase of properties, drilling and completion of public supply permitted water wells, construction of a desalination water treatment facility, and installation of a pipeline to El Paso. Project water will be obtained from two wellfields, the first capturing Capitan Reef Aquifer underlying property referred to as Diablo Farms (Phase 1; E-16), and the second wellfield developed in the Bone Springs-Victorio Peak Aquifer underlying the local Dell Valley irrigated area (Phase 2; E-17).

In 2003 and 2004, EPW purchased about 28,000 acres of land (Diablo Farms) overlying the Capitan Reef Aquifer. The property straddles the Hudspeth and Culberson County lines adjacent to the Salt Basin southeast of Dell City. The property is currently leased out for irrigated agricultural use, and until the construction phase is started, the land will continue to be used for agricultural purposes. The proposed strategy calls for production of up to 10,000 acre-feet per year from six new wells beginning in 2040.

EPW has completed preliminary evaluations of groundwater availability in the area and estimates that recharge to this portion of the Capitan Reef Aquifer ranges from 10,000 to 20,000 acre-feet per year. TDS concentrations in the area range from 850 to 1,500 mg/L. All the currently operating irrigation wells on Diablo Farms have TDS values below 1,000 mg/L. However, it is expected that significant increases in pumping amounts would result in movement of poorer quality groundwater into the area.

The evaluation concluded that pumping less than 10,000 acre-feet per year would not require desalination. Pumping between 10,000 and 25,000 acre-feet per year would not result in mining of the Aquifer, but the groundwater would likely have to be desalinated over time as the intrusion of poorer quality water into the wellfield area increases salinity.

It is assumed that the transmission facilities for this project would be shared with the Dell City groundwater project - Phase 2 (Strategy E-17), and that the pipeline will have sufficient capacity to carry the volume of water at full development of both projects (10,000 acre-feet per year from Diablo Farms and 10,000 acre-feet per year from Dell City). EPW already owns the property at Diablo Farms, so land acquisition is limited to pipeline right-of-way (100 foot).

Quantity, Reliability, and Cost – The volume of water generated from this strategy will be 10,000 acre-feet per year beginning in the 2040 decade. The capital cost of the project is approximately $569,357,000.

E-17 Groundwater from Dell City Area (Phase II)

Dell City is located approximately 75 miles east of El Paso, near the New Mexico-Texas border and is underlain by the Bone Spring-Victorio Peak Aquifer, which covers 130 square miles on the Texas side of the state border. Importation of 10,000 acre-feet per year from the Bone Spring-Victorio Peak Aquifer is proposed by 2050.

The Hudspeth County Underground Water Conservation District No.1 (HCUWCD #1) sustainably manages the aquifer for through regulatory rules as established in the District's groundwater management plan. The modeled available groundwater (MAG) established for the aquifer is 101,400 acre-feet per year assuming an irrigation return flow of 30 percent. Aquifer withdrawals from the Bone Spring-Victorio Peak Aquifer at the proposed pumping rates for this strategy are at a sustainable level based on the current rules of the HCUWCD #1.

Approximately 45 acre-feet per year is withdrawn from the aquifer for municipal use by the community of Dell City, with the remainder used for irrigated agriculture. Water from this aquifer has concentrations of iron, chloride, nitrate, sulfate, and aluminum that exceed water quality standards for municipal supply. With total dissolved solids ranging from 1,810 to 3,900 mg/l, desalination would be required before the source could be used for municipal purposes.

The first decade (2060) of the Dell City project includes the drilling and construction of seven wells plus one contingency well with accompanying pumps, pipelines and other appurtenances, a pump station, 12 miles of 42-inch pipeline, expansion of the existing pump stations on the Diablo Farms (Phase 1) to El Paso pipeline, and an 18 MGD desalination facility with disposal wells. The water from the desalination facility will be blended with untreated water to produce the desired water quality.

The second decade (2070) of the project adds the drilling and construction of eight more wells with the associated facilities, another expansion of the pump stations on the pipeline to El Paso, and an 18 MGD expansion of the desalination facility. Also included is $55 million for purchase of additional property, for a total of $110 million between the two decades of the project

Quantity, Reliability, and Cost - The volume of water generated from this strategy will be 10,000 acre-feet per year beginning in the 2050 decade. The project includes the drilling and completion of water-supply wells, a desalination and brine disposal facility, and a pipeline connecting the Phase 2 project supply to the Phase 1 transmission pipeline to El Paso. The capital cost for this strategy is estimated at $320,226,000.

E-18 Treatment and Reuse of Agricultural Drain Water (ALTERNATE)

The 2011 Far West Texas Water Plan included a strategy to develop two 5 MGD desalination plants at the Rogers and Canal Water Treatment Plants to treat agricultural drain water for municipal use. Hazen and Sawyer, P.C. since completed a study on the treatment of drain water near the Upper Valley Water Treatment Plant using conventional treatment and blending with other sources to meet water quality standards. This strategy in the 2016 Plan proposed using the same combination of conventional treatment and blending at the Rogers and Canal Plants for the facility at the Upper Valley WTP examined in the Hazen and Sawyer study. This current 2021 strategy now assumes that a 2.41 MGD (2,700 acre-feet per year) plant renovation (see strategy E-14) will be built at the Upper Valley WTP in the 2030 decade.

The use of conventional treatment eliminates the need for brine disposal. However, it does require the availability of lower TDS treated water source in sufficient quantity for blending. The Hazen and Sawyer study found that hardness was a controlling factor, along with TDS, in determining blending ratios with treated water from the Upper Valley WTP. Blend ratios varied from approximately 4 to 1 to more than 14 to 1, depending on target water quality. If additional treatment such as desalination becomes necessary, the strategy's cost estimate will be impacted. This strategy assumes that the treatment waste stream will most likely be discharged directly into the sewer system with solids going to a landfill.

Quantity, Reliability, and Cost - The volume of water generated from this strategy will be 2,700 acre-feet per year beginning in the 2040 decade. The total capital cost for the water treatment plant is estimated to be approximately $21,466,000.

E-19 Expansion of Canutillo Mesilla Bolson Wellfield (ALTERNATE)

A portion of EPW's groundwater supply is obtained from their Canutillo wellfield in the Mesilla Bolson Aquifer on the west side of the Franklin Mountains. Groundwater in this location of the aquifer occurs in three separate horizons with varying water quality, including elevated levels of arsenic which must be treated to drinking-water standards. Groundwater retrieved from the Canutillo wellfield is transported to the Upper Valley WTP for further treatment including arsenic remediation (see Strategy E-14).

The strategy includes the completion of 10 new wells at an average depth of 200 feet and pumping capacity of 500 GPM in the existing wellfield and a pipeline to transport the groundwater to the Upper Valley WTP. Wellhead RO filtration is also being considered for wells contending with high arsenic levels, but is not included in this current analysis. The cost of drilling and equipping 10 new wells includes an additional contingency of 35 percent has been added to the cost, as well as allowances for permitting and mitigation, land acquisition, and interest during construction. The strategy also includes a pipeline to the Upper Valley WTP.

Quantity, Reliability, and Cost - This strategy is scheduled to begin initial implementation by 2030 with the production of 7,760 acre-feet per year of new supply and increases each decade to a total of 23,280 by the 2070 decade. Total capital cost for this strategy is $6,444,000 million. Pumping from the Canutillo wellfield can impact flows in the Rio Grande and is monitored by the Bureau of Reclamation.

E-20 Lower Valley Wellhead RO Desalination (ALTERNATE)

This strategy assumes that five new water wells will be drilled and completed in the Rio Grande Alluvium Aquifer in the Lower Valley to provide an additional 5,000 acre-feet per year of municipal supply. As the raw groundwater from this aquifer is slightly brackish, each well will be equipped with a reverse osmosis desalination filtration system. The resulting supply that will meet safe drinking water standards will be connected directly to the nearest distribution pipeline. The brine concentrate generated from the wells will be discharged to the sewer system. The cost estimate includes the five new wells, associated pipelines, storage, pumps and power.

Quantity, Reliability, and Cost - The five new wells are assumed to be drilled to a depth of 500 feet to provide an additional supply of 5,000 acre-feet per year beginning in 2040. Historical municipal, agricultural and industrial use indicates that the Rio Grande Alluvium Aquifer is a viable source. The total capital cost of this project will be approximately $52,681,000.

E-21 Expansion of Jonathan Rogers WTP (ALTERNATE)

EPW currently obtains surface water from the Rio Grande in accordance with a series of contracts with EPCWID #1, the U.S. Bureau of Reclamation, and the Lower Valley Water District. These contracts allow the conversion of water allocated for irrigation of lands owned or leased by EPW into municipal supply. Over time, EPW may increase the annual diversion from surface water by converting additional water allocated to irrigated lands in El Paso County. The conversion of water for municipal supply will require amendments to contracts or agreements with the U.S. Bureau of Reclamation and EPCWID #1.

This strategy assumes that the increased surface water supply will require additional treatment capacity. Currently, the Jonathan Rogers Water Treatment Plant capacity is 60 MGD. The proposed strategy will increase the capacity to 80 MGD by replacing and enhancing existing treatment facilities. A preliminary design of the plant expansion by CH2M Hill Engineers, Inc. is the basis for the cost estimates for this strategy. Costs associated with the acquisition of irrigation rights are not included.

Quantity, Reliability, and Cost - This strategy to be implemented by 2040 will provide up to 6,500 acre-feet of treated water per year, based on a 7-month irrigation season and assuming a peaking factor of 2. The actual quantity of water is dependent on new irrigation properties acquired by EPW and the availability of surface water from the Rio Grande Project, which varies from year to year. The estimated total capital cost for this strategy is approximately $88,679,000.

E-22 Conjunctive Treatment of Groundwater and Surface Water at the Upper Valley WTP (ALTERNATE)

The Upper Valley Water Treatment Plant located north of Vinton is one of the largest water-treatment facilities in the nation built as a direct result of the EPA revision to the federal regulation of arsenic levels in drinking water. The areas served by the plant include Upper Valley, West Side, Canutillo, Vinton and Westway. The existing plant removes arsenic occurring within groundwater pumped from wells in the Canutillo Wellfield (see strategy E-6), and treats up to 30 MGD of this groundwater for blending with up to 30 MGD of untreated groundwater to produce a finished product with an arsenic concentration of 8 ppm or less. For this strategy, the existing plant will be enlarged and renovated to treat proposed new water sources including additional groundwater from the Canutillo Wellfield and, raw Rio Grande surface water delivered from a proposed new La Union diversion point (see EPCWCID#1 strategy), and other agricultural drain water sources.

Quantity, Reliability, and Cost - The improvement to the plant will produce 10,000 acre-feet per year of additional water supply and is planned to go into operation in 2030. The estimated total capital cost for this strategy is approximately $72,873,000.

E-23 Advanced Water Purification at the Fred Hervey WRP (ALTERNATE)

The Fred Hervey Water Reclamation Plant treats 12 MGD of wastewater from nearby homes, businesses and industries. The reclaimed water is sent to irrigation and industrial customers including the Newman Power Plant, Painted Dunes Golf Course and the Northeast Regional Park. The plant further treats reclaimed water to drinking water standards and uses it to replenish the aquifer through injection wells and infiltration basins. It was among the first in the nation to create drinking-quality water by treating used water and demonstrate the feasibility of artificial aquifer recharge.

The Fred Hervey Advanced Water Purification strategy includes additional conventional wastewater treatment at the existing plant to remove nutrients, an advanced treatment facility (microfiltration/ultrafiltration, nanofiltration or reverse osmosis, ultraviolet/advanced oxidation process, activated carbon and chlorine disinfection) and storage. The conceptual design and cost for the strategy were based on the Bustamante Advanced Water Purification Plant. The additional purified water will be placed directly into the distribution system. Disposal of the waste stream was assumed to be by deep well injection and to be approximately 30% of the amount treated.

Quantity, Reliability, and Cost - The improvement to the plant will produce around 10,000 acre-feet per year of additional water supply and is planned to go into operation in 2040. The capital cost for this strategy is estimated at $140,394,000.

5A-5 WATER MANAGEMENT STRATEGIES FOR THE LOWER VALLEY WATER DISTRICT

The Lower Valley Water District (LVWD) is located in the southeastern portion of El Paso County and currently offers water, wastewater and solid waste services to residents within a distribution system of 210 square miles east of the City of El Paso city limits. The City of Socorro, the community of San Elizario, the Town of Clint, El Paso County Sparks Addition, Sand Hills and other El Paso County Colonias are located within the LVWD's boundaries. The LVWD's sole source of water is purchased from the combined (blended) EPW sources developed in the previously described EPW Integrated Strategy (5A-4). The LVWD transfers its Rio Grande water rights to EPW and, in exchange, receives treated water ready for distribution. The LVWD is proposing several new sources of water that will help limit the supplies delivered by EPW to roughly current levels, and obtain additional supply needed for growth independently. The LVWD has a projected water-supply deficit of 1,358 acre-feet per year in 2020 increasing to 5,689 by 2070. The following water management strategies are recommended to enhance the reliability of the LVWD's future water supply availability:

- (E-24) Public conservation education
- (E-26) Purchase water from El Paso Water (EPW)
- (E-27) Surface water treatment plant and transmission line
- (E-28) Groundwater from proposed wellfield – Rio Grande Alluvium Aquifer
- (E-29) Groundwater from proposed wellfield – Hueco Bolson Aquifer
- (E-30) Wastewater treatment facility and ASR

The LVWD active projects, which are currently being funded through other financial measures offered by the TWDB, include extension of its collection system and a water main replacement. The District is also very interested in addressing an issue of low pressure in its distribution system. Several lines dead end, which results in low pressure at the distal end of the lines. Low pressure is resulting in excessive use of water due to the need to flush toilets more than once to clear the sanitary lines. By looping the dead-end lines, adequate pressure can be maintained, thus conserving a significant volume of water.

E-24 Public Conservation Education

Public information programs, even though they may not be directly related to any equipment or operational change, can result in both short- and long-term water savings. Behavioral changes by customers will only occur if a reasonable yet compelling cause can be presented with sufficient frequency to be recognized and absorbed by the customers. There are many resources that can be consulted to provide insight into implanting effective information programs. Like any marketing or public information program, to be effective, water conservation public information should be planned out and implemented in a consistent and continual manner. A more detailed description of conservation BMPs that might be encouraged is available in *TWDB Report 362, Water Conservation Best Management Practices Guide.* These BMPs can also be found at: http://www.twdb.texas.gov/conservation/outreach/index.asp

The LVWD is encouraged to emphasize conservation through public information programs. A total of one percent reduction in demand is anticipated, which would result in a water savings of 57 acre-feet per year in 2020; increasing to 100 acre-feet per year in 2070. The annual cost for implementing a public information conservation program is estimated at $35,956 in 2020; increasing to $41,954 in 2030. The total capital cost for this strategy is assumed to be $237,461.

E-26 Purchase Water from El Paso Water (EPW)

The LVWD has historically purchased its water supply from EPW and furnishes this supply to its wholesale and retail customers. This strategy provides for the purchase of additional water supplies from EPW to meet the projected future supply needs of its customers. The total volume of treated water available for purchase from EPW is contingent on the Rio Grande water-right volume transferred to EPW the LVWD. The purchased supply is also reliant on EPW maintaining its blended water supply and implementation of its Integrated Strategies (5A-4).

Quantity, Reliability and Cost -This strategy assumes that LVWD would purchase an additional 1,344 acre-feet per year of water in 2020 and increasing to 5,632 acre-feet per year by 2070 from EPW at a cost of $440 per acre-foot. The annual cost for the water purchase increases from $591,000 in 2020 to $2,478,000 in 2070. The estimated quantity of supply for this strategy is dependent on EPW maintaining its blended water supply and implementing its Integrated Strategies. The reliability of this supply is high, assuming EPW successfully implements their Integrated Strategies. In contrast to many other water management strategies, there are no capital costs associated with the purchase EPW water strategies.

E-27 Surface Water Treatment Plant and Transmission Lines

The canals that serve as the primary surface water source in the El Paso area divert water from the Rio Grande upstream of El Paso wastewater discharges. Currently, the flows in the Rio Grande in the vicinity of the Lower Valley Water District (LVWD) contains a large percentage of wastewater discharges, originating from both the City of El Paso and the Mexican City of Juarez. The most feasible surface water supply alternative available to the LVWD is to build an intake on the American Canal upstream of the intake for the Jonathan Rogers Water Treatment Plant (WTP), which is owned by El Paso Water (EPW). This strategy assumes that the LVWD and the El Paso County WID #1 come to an agreement to deliver the water to the proposed intake location. Furthermore, this strategy assumes that the LVWD will hold all necessary future Rio Grande Project (RGP) leased water rights. In addition, the LVWD will need to inform EPW that they will be providing their own supplemental water supplies in the future. The obligation of EPW to provide water via the Jonathan Rogers WTP would be limited to the pro rata share of the plant capital costs paid by the LVWD. From that point on, future RGP water rights obtained via lease from agricultural properties would not be traded to EPW, but rather the LVWD would utilize them directly. This source is currently used for agricultural purposes, and thus this strategy will reduce the amount of water currently available to agricultural users. It is assumed that the transfer of water rights will be between a willing buyer and a willing seller, and therefore minimal impact to agricultural users is anticipated.

This strategy assumes that the surface water supplies are only available seasonally, and therefore water will only be provided during the irrigation season (approximately March through October). The LVWD will need to either purchase water from EPW during the winter months, utilize a groundwater supply source, or construct an Aquifer Storage and Recovery (ASR) project to provide the balance of supplies needed to meet future system demands.

The Surface Water Treatment Plant and Transmission Lines Strategy has been studied in detail by the LVWD. Project components include the purchase of 24 acres, construction of a new intake and pump station on the American Canal, a 1.6 mile 24-inch pipeline to a new 10 MGD water treatment plant, a ground storage tank providing 4 hours of storage at peak flow and a pump station at the WTP, and finally a 0.4 mile 24-inch pipeline to transport water from the WTP to the existing distribution system. Exact locations for these facilities are presently undetermined. Engineering preliminary studies are recommended to determine the best location for these facilities. It is anticipated that the new treatment plant will be designed to treat approximately 10 MGD and be similar in design to the Jonathan Rogers WTP as it is important to produce water that is not significantly different in pH or corrosiveness in order to blend well with EPW water.

Quantity, Reliability, and Cost – This strategy will supply an additional 5,000 acre-feet per year of treated water. The proposed plant has a maximum operating capacity of 10 MGD. However, the plant will only provide water seasonally (approximately March through October). The new supply would go directly into customer distribution. The reliability of this project is medium to high depending on available river supplies. The total estimated capital cost for this strategy is $74,338,000.

E-28 Groundwater from Proposed Wellfield – Rio Grande Alluvium Aquifer

For the LVWD to provide a balance of supplies needed to meet future system demands, the Surface Water Treatment Plant (Strategy E-27) will operate in conjunction with a groundwater project. Groundwater supply sources from both the Rio Grande Alluvium (E-28) and Hueco Bolson Aquifers (E-29) are being considered to acquire water supply for the four months that surface water is not available.

This strategy assumes that the wellfield will produce a supply of 10 MGD. A desalination facility (8.3 MGD) utilizing deep-well injection (1.5 MGD) for concentrate disposal will be required. It is recommended that the location of the wellfield be close to the existing distribution system to reduce the costs of transmission line. A 3-mile pipeline will transport the new supply to the storage facilities. Since the Rio Grande Alluvium Aquifer is high in total dissolved solids (TDS), advanced treatment will be required for municipal purposes, which includes a 2 MGD ground-storage tank and the purchase of 80 acres of land for the plant and another 280 acres for the wellfield.

Seven new wells, with approximately 2,200 feet of well-spacing, will be drilled to produce water from 150 feet below the surface. Each water well will have a capacity of approximately 1,000 gpm. The design of the wellfield is to operate in conjunction with the Surface Water Treatment Plant (Strategy E-27) during the winter period when surface water is limited.

Quantity, Reliability, and Cost – The quantity of water produced from seven wells over a four-month period is approximately 6,800 acre-feet per year. Capital costs for public supply wells completed in the Rio Grande Alluvium Aquifer are based on 1,000 gpm wells with 16-inch production casing, drilled to an average total depth of 150 feet, pumping equipment and site improvement. The estimated cost for a single well completed in this Aquifer is $835,000. The total estimated capital cost for this project is $39,240,000, which includes the desalination facility.

The Rio Grande Alluvium Aquifer has shown that it can be considered reliable as a water supply if properly developed and is not compromised by additional water demands. This strategy could potentially compete for groundwater that at times is used for agricultural purposes; however, the aquifer is currently being used at less than sustainable capacity.

E-29 Groundwater from Proposed Wellfield – Hueco Bolson Aquifer

Production from a wellfield completed in the Hueco Bolson Aquifer is a second groundwater alternative being considered by the LVWD as a feasible strategy to help supplement the proposed Surface Water Treatment Plant (Strategy E-27). In winter, surface water supplies cannot provide the water supply needed to accommodate the growing water demands. To acquire water supply for the four months that surface water is not available, the LVWD has studied in detail the feasibility of developing a new wellfield in the Hueco Bolson Aquifer.

This strategy assumes six new wells with approximately 2,500 feet of well spacing will be drilled to produce water from 650 feet below the surface. Each water well will have a capacity of approximately 1,000 gpm. It is assumed that the wellfield will produce a supply of 10 MGD. A desalination facility (8.3 MGD) utilizing deep-well injection (1.5 MGD) for concentrate disposal will be required. It is recommended that the location of the wellfield be close to the existing distribution system to reduce the costs of transmission line. A 3-mile pipeline will transport the new supply to the storage facilities. This strategy also includes a 2 MGD ground storage tank and the purchase of 80 acres of land for the plant and another 360 acres for the proposed wellfield.

Quantity, Reliability, and Cost –The LVWD is proposing to use this strategy in conjunction with the Surface Water Treatment Plant (Strategy E-27), only during the winter period when the availability of surface water is limited. The supply yield during this designated period of production will provide an additional supply of approximately 6,800 acre-feet per year.

The capital costs associated with this strategy are based on six 1,000 gpm wells with 16-inch production casing drilled to an average total depth of 650 feet, pumping equipment and site improvement. The estimated capital cost for a single well completed in the Hueco Bolson is approximately $835,000. The total estimated capital cost for this project is approximately $36,110,000. Production from the Hueco Bolson is more expensive compared to the Rio Grande Alluvium due to the increased capital costs required for deeper wells, increased pumping costs, and the increased costs associated with pumping from a confined aquifer. The Hueco Bolson Aquifer has shown that it can be considered reliable as a water supply if properly developed and is not compromised by additional water demands.

E-30 Wastewater Treatment Facility and ASR

To provide the balance of supplies needed to meet future system demands, along with strategies E-27, E-28, and E-29), the LVWD is also considering the possibility of constructing a wastewater treatment facility and an aquifer storage and recovery (ASR) project similar to El Paso Water's Fred Hervey Water Reclamation Plant and aquifer recharge project. The concept of this strategy is to tertiary treat wastewater to near drinking-water standards, inject specified volumes into the distribution system, and store the surplus amount into the Hueco Bolson Aquifer for later recovery.

There are three potential sources of water that could be stored and recovered in the ASR project: (1) excess treated surface water (strategy E-27); (2) treated wastewater provided by EPW; or (3) excess LVWD treated wastewater. The first option would include pumping water from the American Canal at a rate equivalent to taking the full 6.8 MGD over eight months instead of the twelve and deposit the excess in the ASR for use in the winter. The second option would require that EPW modify its treatment train to produce water to a quality suitable for ASR. The third option requires the LVWD build its own wastewater treatment facility. It is recommended that additional studies be conducted to better determine the feasibility of each of these options.

The Hueco Bolson Aquifer is considered as the ASR repository as it has more potential storage volume and is less subject to outside pumping that might pirate a portion of the injected supply. However, the Rio Grande Alluvium may also be an option for the ASR if the Hueco Bolson is determined to be infeasible.

For this strategy, the third option is chosen for consideration in this strategy and thus considers the construction of a new 3 MGD tertiary wastewater treatment facility, an ASR facility consisting of two 650-foot wells capable of both injection and withdrawal, and 5,280 feet of 12-inch diameter wellfield piping.

Quantity, Reliability, and Cost – The strategy assumes that an estimated 5,589 acre-feet per year of treated water will be injected into the Hueco Bolson Aquifer. The total capital cost is approximately $23,509,000. Reuse of existing supplies makes this treated supply reliable.

5A-6 WATER MANAGEMENT STRATEGIES FOR HORIZON REGIONAL MUNICIPAL UTILITY DISTRICT (MUD)

The Horizon Regional MUD's mission is to provide affordable, high quality drinking water and environmentally sound wastewater treatment and disposal. The Utility District operates a state-of-the-art reverse osmosis water treatment plant servicing residents within an area of approximately 91,000 acres. The District relies on the Hueco Bolson Aquifer and the Rio Grande Alluvium Aquifer for its municipal water supply needs. Drawing from the Rio Grande Alluvium Aquifer, the District converts brackish groundwater into six million gallons of drinking water per day. The District has plans to expand production by an additional two million gallons per day.

Horizon Regional MUD has a projected water supply deficit of 2,709 in 2020; increasing to 17,008 by 2070. The following water management strategies are recommended to enhance the reliability of the Utility District's future water supply availability:

- (E-31) Water Loss Audit and Main-line Repair
- (E-32) Public conservation education
- (E-33) Drill additional wells and expansion of desalination plant

E-31 Water Loss Audit and Main-line Repair

According to the 2015 TWDB Public Water System Water Loss Survey, the Horizon Regional Municipal Utility District had real water losses (as opposed to apparent "paper" losses) of 688 acre-feet in 2015 (12.5 percent) due to leaking infrastructure. This amount of water loss is the sum of reported breaks and leaks, and unreported loss. The water supply system can reduce water losses and get a more accurate look at water consumption by taking the proper measures to identify and repair old infrastructure and inaccurate water meters. This strategy will provide a savings of only a portion of the total reported loss and assumes that a leak testing program would be implemented prior to possibly replacing portions of the existing leaking pipe.

Quantity, Reliability and Cost - The strategy assumes 1 mile of 6-inch diameter pipe will be replaced, at a total estimated project capital cost of $255,000. The strategy is estimated to generate a potential savings of 197 acre-feet of water per year in 2020 and up to 551 acre-feet per year by 2070. The increase in estimated savings is due to a corresponding increase in demand over the planning period.

E-32 Public Conservation Education

Public information programs, even though they may not be directly related to any equipment or operational change, can result in both short- and long-term water savings. Behavioral changes by customers will only occur if a reasonable yet compelling cause can be presented with sufficient frequency to be recognized and absorbed by the customers. There are many resources that can be consulted to provide insight into implanting effective information programs. Like any marketing or public information program, to be effective, water conservation public information should be planned and implemented in a consistent and continual manner. A more detailed description of conservation BMPs that might be encouraged is available in *TWDB Report 362, Water Conservation Best Management Practices Guide.* These BMPs can also be found at: http://www.twdb.texas.gov/conservation/outreach/index.asp

Horizon Regional MUD is encouraged to emphasize conservation through public information programs. A total of one percent reduction in demand is anticipated, which would result in a water savings of 79 acre-feet per year in 2020; increasing to 222 acre-feet per year in 2070. The annual cost for implementing a public information conservation program is estimated at $19,714 in 2020; increasing to $25,467 in 2030. This project assumes a total capital cost of approximately $137,000.

E-33 Additional Wells and Expansion of Desalination Plant

Brackish groundwater is supplied from wells in the Rio Grande Alluvium Aquifer and is desalinated through a 6.0 MGD plant. The MUD also has wells in the Hueco Bolsons Aquifer that do not require desalination. The Horizon Regional MUD will require additional infrastructure to produce the needed supply in the decade beginning in the year 2020. This strategy assumes that five additional wells will be drilled in the Rio Grande Alluvium and four in the Hueco Bolsons Aquifer. The five wells in the Rio Grande Alluvium will need to be drilled at approximately 150 feet below the surface. The four wells in the Hueco Bolsons Aquifer will be produced at a depth of 500 feet. These wells combined are anticipated to have an average capacity of 1,200 gpm. This strategy also includes expanding the desalination plant from the 6.0 MGD to 21.4 MGD.

Quantity, Reliability, and Cost – The nine proposed wells will have a total production capacity of 16,786 acre-feet per year. The groundwater source will continue to be brackish and will be converted to fresh quality through the desalination facility. The capital cost for this project is estimated at $71,809,000. There is a significant quantity of brackish quality water in the Rio Grande Alluvium Aquifer; therefore, the source is considered very reliable. Since this strategy relies on brackish supplies that are only occasionally used for agricultural irrigation users, competition for the water is expected to be minimal.

5A-7 WATER MANAGEMENT STRATEGIES FOR HACIENDAS DEL NORTE WID

E-34 Water Loss Audit and Main-line Repair

According to the 2015 TWDB Public Water System Water Loss Survey, the Haciendas Del Norte Water Improvement District had real water losses (as opposed to apparent "paper" losses) of 27 acre-feet in 2015 (16.1 percent) due to leaking infrastructure. This amount of water loss is the sum of reported breaks and leaks, and unreported loss. The water supply system can reduce water losses and get a more accurate look at water consumption by taking the proper measures to identify and repair old infrastructure and inaccurate water meters. This strategy will provide a savings of only a portion of the total reported loss and assumes that a leak testing program would be implemented prior to possibly replacing portions of the existing leaking pipe.

Quantity, Reliability and Cost - The strategy assumes 3 miles of 6-inch diameter pipe will be replaced, at a total estimated project capital cost of $764,000. The strategy is estimated to generate a potential savings of 12 acre-feet of water per year in 2020 and up to 19 acre-feet per year by 2070.

5A-8 WATER MANAGEMENT STRATEGY FOR EAST MONTANA WS

E-35 Water Loss Audit and Main-line Repair

According to the 2016 TWDB Public Water System Water Loss Survey, the East Montana Water System had real water losses (as opposed to apparent "paper" losses) of 155 acre-feet in 2016 (15.1 percent) due to leaking infrastructure. This amount of water loss is the sum of reported breaks and leaks, and unreported loss. The water supply system can reduce water losses and get a more accurate look at water consumption by taking the proper measures to identify and repair old infrastructure and inaccurate water meters. This strategy will provide a savings of only a portion of the total reported loss and assumes that a leak testing program would be implemented prior to possibly replacing portions of the existing leaking pipe.

Quantity, Reliability and Cost - The strategy assumes 4 miles of 6-inch diameter pipe will be replaced, at a total estimated project capital cost of $1,018,000. The strategy is estimated to generate a potential savings of 41 acre-feet of water per year in 2020 and up to 63 acre-feet per year by 2070.

5A-9 WATER MANAGEMENT STRATEGIES FOR EL PASO COUNTY TORNILLO WID

The township of Tornillo is an unincorporated community in El Paso County with a current population of 3,202 people and has been designated as a "Colonia". The El Paso County Tornillo Water Improvement District provides water services to approximately 985 connections, mostly residential, within the community. The District is self-supplied and relies on the Hueco Bolson Aquifer for municipal water supply needs. Although the supply-demand analysis does not project a future water supply deficit for El Paso County Tornillo WID, the following water management strategy is recommended to enhance the reliability of the District's future water supply availability:

E-36 Additional Groundwater Well and Transmission Line

The District with support from El Paso County received funding to construct a new well in the Hueco Bolson Aquifer, which was completed and online by the end of 2010. The District is expecting to need an additional well in the future to meet local population growth. Water produced from these wells will be included in the arsenic treatment process upon completion of the treatment facility.

This strategy assumes the development of one new well at a depth of 400 feet. The well is assumed to be operating at a capacity of 310 gpm. In addition, this strategy includes 0.25 miles of 6-diameter transmission line. Minimal treatment, such as chlorine disinfection, will be required for municipal purposes.

Quantity, Reliability, and Cost – This strategy will yield an additional water supply of 333 acre-feet per year. The estimated total capital cost for this project is $2,060,000. Reliability of this source is high due to the Hueco Bolson Aquifer being a prolific aquifer. Modeling indicates that the Aquifer can be sustainably developed beyond previous estimates. However, development of Hueco Bolson groundwater may have a minor impact on other wells used for agricultural and rural purposes.

5A-10 WATER MANAGEMENT STRATEGIES FOR EL PASO COUNTY-OTHER (VINTON HILLS)

El Paso County-Other Vinton Hills Estates and Vinton Hills Subdivision are combined in this Plan as Vinton Hills. Together, they have a projected population of 1,231 in 2020; increasing to 3,277 by 2070. Vinton Hills Estates and Subdivision have a combined projected water supply deficit of 14 acre-feet in 2050; increasing to 138 acre-feet by 2070. The following water management strategies for the two combined areas are recommended to enhance the reliability of the future water supply availability for El Paso County Other – Vinton Hills:

- (E-37) Public Conservation Education
- (E-38) Purchase water from El Paso Water (EPW)

E-37 Public Conservation Education

Public information programs, even though they may not be directly related to any equipment or operational change, can result in both short- and long-term water savings. Behavioral changes by customers will only occur if a reasonable yet compelling cause can be presented with sufficient frequency to be recognized and absorbed by the customers. There are many resources that can be consulted to provide insight into implanting effective information programs. Like any marketing or public information program, to be effective, water conservation public information should be planned and implemented in a consistent and continual manner. A more detailed description of conservation BMPs that might be encouraged is available in *TWDB Report 362, Water Conservation Best Management Practices Guide.* These BMPs can also be found at: http://www.twdb.texas.gov/conservation/outreach/index.asp

County-Other entities are encouraged to emphasize conservation through public information programs. EPW will likely provide this service to many of the citizens in this category. This strategy has been developed for both Vinton Hills Estates and Vinton Hills Subdivision to meet their projected future supply water needs. A total of one percent reduction in demand is anticipated, which would result in a water savings of 2.8 acre-feet by year 2030. The 2030 annual cost for implementing a public information conservation program is estimated at $1,119.

E-38 Purchase Water from El Paso Water

El Paso County-Other entities have historically purchased a portion of their water supply from EPW. This strategy provides for the purchase of additional supplies from EPW by Vinton Hills Estates and Vinton Hills Subdivision to meet their projected future supply needs.

Quantity, Reliability and Cost -This strategy assumes that Vinton Hills will purchase a combined amount of 10 acre-feet of water per year from EPW starting in 2050 and increasing to 133 acre-feet per year by 2070 at a cost of $1,041 per acre-foot. The total annual cost for the water purchase is approximately $15,000 in 2050 and $143,000 by 2070. The purchased supply is reliant on EPW maintaining its blended water supply and implementation of its Integrated Strategies.

El Paso County Other (Vinton Hills)	2020	2030	2040	2050	2060	2070
Supply Amount (ac-ft/yr)	0	0	0	10	73	133
Total Annual Cost ($/year)	$0	$0	$0	$15,000	$75,993	$138,453

The estimated quantity of supply for this strategy is dependent on EPW maintaining its blended water supply and implementing its Integrated Strategies. Supply amounts for individual WUGs range from 0 to 7,260 acre-feet. The reliability of this supply is high, assuming EPW successfully implements their Integrated Strategies. In contrast to many other water management strategies, there are no capital costs associated with the purchase EPW water strategies

5A-11 WATER MANAGEMENT STRATEGIES FOR EL PASO COUNTY IRRIGATION (EPCWID #1)

Irrigation shortages in El Paso County are the direct result of insufficient water in the Rio Grande during drought-of-record periods to meet anticipated needs. Thus, the quantity of water needed to meet the full demands cannot be realistically achieved during drought conditions and farmers in these areas have generally approached this situation by supplementing supplies with Rio Grande Alluvium Aquifer groundwater, reducing irrigated acreage, changing types of crops planted, or possibly not planting crops until water becomes available during the following season.

In some cases farmers may benefit from Best Management Practices (BMPs) for agricultural water users, which are a mixture of site-specific management, educational, and physical procedures that have proven to be effective and are cost-effective for conserving water. The Texas Water Development Board (TWDB), through the Water Conservation Implementation Task Force has published a report title *Water Conservation Best Management Practices* Guide (TWDB Report 362), which in part contains numerous BMPs for agricultural water users. These agricultural BMPs can also be found at: http://www.twdb.texas.gov/conservation/BMPs/Ag/index.asp

During previous planning periods, the FWTWPG sponsored and the TWDB funded an interim project to evaluate the effectiveness of previously recommended irrigation BMP strategies. The evaluation was conducted by the Texas AgriLife Research Center in El Paso. The entire report can be viewed at http://www.twdb.texas.gov/publications/reports/contracted_reports/doc/0704830690_RegionE/TxAgriLifeResearchIrrigationEfficiency-FinalReport.pdf.

The overall conclusion is that very limited opportunities exist for significant additional water conservation in Far West Texas irrigated agriculture. Those practices that suggest economic efficient additional water conservation include lining or pipelining district canals and the very small potential for additional irrigation scheduling and tail water recovery systems. In nearly all cases, these practices have been adopted to a large extent if applicable, further emphasizing the very limited opportunities for additional conservation. If all of these strategies were implemented, the water conserved would satisfy less than 25 percent of the projected unmet agricultural water demand in 2070 during drought-of-record conditions.

Based on this evaluation, the FWTWPG recommends the following conservation and reuse strategies: irrigation scheduling, tailwater reuse, and improvements to water district delivery systems. These strategies are intended for irrigation practices within the El Paso County Water Improvement District #1 (EPCWID#1). The potential water savings under both drought and full supply conditions is shown in the table below.

Potential Water Savings for EPCWID #1

BMP Strategy	Drought	Full
Scheduling (subtotal)	1,740	5,070
Pivot Sprinkler	-	-
Surface Irrigation	-	-
Pipeline / Lining District Canals	25,000	50,000
Tailwater Reuse	1,723	6,274
Total	**28,463**	**61,344**

El Paso County has approximately 16,570 acre-feet per year of an irrigation shortage in 2020, which decreases to 13,042 acre-feet per year by 2070. The following water management strategies are recommended to enhance the reliability of the future water supply availability for the irrigation needs within El Paso County:

- (E-40) Irrigation scheduling
- (E-41) Tailwater reuse
- (E-42) Improvements to water district delivery systems
- (E-43) Riverside Regulating Reservoir
- (E-44) New Rio Grande diversion point at La Union Canal

E-40 Irrigation Scheduling

This strategy is intended for producers with an adequate supply of water throughout the growing season. It involves scheduling the time and amount of water that is applied to a crop based on the amount of water present in the crop root zone, the amount of water consumed by the crop since the last irrigation, and other considerations. Water savings are difficult to quantify and vary from year to year based on cropping practices, water quality, and quantity. It is estimated that 0.3 to 0.5 acre-feet of water per acre may be saved.

Due to recent droughts, EPCWID #1 has made several changes to aid the agricultural sector. Farmland is currently being irrigated with effluent (sewer treated) water. In 2015, 10,000 acres were irrigated in this manner. Also, modifications have been made to the local irrigation schedule. Farmers will now wet their lands for planting starting in February (irrigating as much as possible), up until the beginning of the irrigation season starting June 1st. This strategy assumes that upon the release of the Rio Grande project water, the project water will be mixed with well water and the effluent water in order to produce more supply to be allocated to other users including El Paso Water.

Quantity, Reliability, and Cost - Costs vary depending upon which scheduling method is used, number of fields scheduled, type of program and technical assistance. Based upon existing research conducted on surface water delivery through a series of canals, laterals, and on-farm distribution system, irrigation scheduling offers the potential to reduce water deliveries between 10 and 25 percent and more depending upon the capabilities of the individual district and producer. The project would have a benefit of 1,740 acre-feet per year. This strategy assumes an annual cost of approximately $102,595.

E-41 Tailwater Reuse

This strategy is applicable to any irrigated system in which significant water quantity runs off the end of the irrigated field. This strategy consists of ditches or pipelines to collect tailwater and deliver it to a storage reservoir or small field pump. The water is then pumped to the upper end of the field and applied with the irrigation water. Water savings from the installation of tailwater reuse systems are highly dependent upon the local water supply (groundwater or surface water) and the current on-farm water management practices of the grower. Water savings will typically vary between 5 and 25 percent of the water applied to the head (upper) end of the field. This may range from a few to several inches (0.5 to 1.5 acre-foot per acre per year).

Quantity, Reliability, and Cost – Reservoirs or pumps costs range between $35 and $70 per acre per year for pump systems and between $60 and $120 per acre per year for reservoir systems. This project will deliver approximately 1,723 acre-feet of water per year and has an estimated annual cost of $973,368.

E-42 Improvements to Water District Delivery Systems

EPCWID #1 continues to implement meaningful irrigation conservation measures. The District provides irrigation water for 69,010 acres, includes 350 miles of canals and 269 miles of drains, and supplies raw water to El Paso Water. Improvements to the water district delivery system include but are not limited to: lining of District irrigation canals, replacement of District canals and lateral canals with pipelines.

Lining of District irrigation canals involves the installation of a fixed lining impervious material in an existing or newly constructed canal. Concrete lining of canals and replacement of headgates has been a critical component of irrigation conservation for the District. EPCWID #1 has lined 15 miles of canals within the last seven years and strives to continue lining approximately 5 miles each upcoming year. This allows for water to be delivered more efficiently to the farms. In addition, in 2015 a joint project between EPCWID #1 and EPWU for $120,000 was implemented to repair and upgrade the canal infrastructure at the headgates.

In 2002, EPCWID #1 received state funding from the TWDB to perform a water and energy conservation feasibility study on lining three canal segments to reduce seepage, construction of check structures and storage, and equalization structures to increase the efficiency and flexibility of water delivery. Funds were available through oil overcharge fees collected by the State Energy Conservation Office and deposited in the Water Bank Account. Water savings involve reduced seepage from the installation of a lining material. Concrete liners are estimated to salvage 80 percent of the original seepage. Costs vary by lining method.

This strategy assumes that replacement of District canals and lateral canals with pipelines involves replacing open canals with buried pipeline that is generally 72 inches in diameter or less. PVC Plastic Irrigation Pipe (PIP) and Reinforced Concrete Pipe (RCP) are the two most commonly used pipelines. Two primary limitations involve cost and water capacity. Water savings stem from reduced seepage. Costs vary and depend on pipe diameter, transportation of pipes, trenching, and other site-specific considerations. Federal funds, state funds and local funds have contributed to the success of this strategy. With the purchase of the proper equipment, the goal is to eventually control the headgates of the system through both the dispatch office and the telemetry system.

Quantity, Reliability, and Cost – The estimated total capital cost for this project is approximately $157,777,783 and will deliver approximately 25,000 acre-feet per year.

E-43 Riverside Regulating Reservoir

To make more efficient use of surface water supplies, EPCWCID #1 has proposed purchasing the City of El Paso former Socorro Pond Sewage Treatment Facility located in the city limits of El Paso near the Bustamante Wastewater Facility.

The regulating reservoir will allow more efficient use of stored water releases from the Rio Grande Project storage reservoirs, as well as flows that originate as stormwater runoff below Caballo Reservoir. The primary source of water stored in the reservoir would be from excess flows diverted at American

Dam and conveyed to the heading of the Riverside Canal. These excess flows primarily consist of storm runoff and operation spills from upstream water users. The temporary stored water would be used either from downstream irrigators or be pumped to the nearby Jonathan Rogers Water Treatment Plant for municipal use. All of the water sources are already authorized through existing state and federal contracts, agreements and water rights. The supply volume is EPCWCID#1's estimate based on increased delivery efficiency in the canal delivery system after diversion from the river, and therefore, environmental flow consideration is not required for this evaluation.

The primary benefits of the project are: (1) Improved farm delivery scheduling and flows; (2) Conservation of water stored in upstream storage reservoir through using water captured in regulating reservoirs to meet downstream demands; and (3) A five-day supply of raw water for use by City of El Paso in case of an emergency such as failure or contamination of American Canal system.

Portions of the project have already been completed, including improvements to the Riverside Franklin Feeder Check Structure; a concreate bridge to the Jonathan Rogers WTP; canal lining; and a flood waste-way to the river.

EPCWID #1 is collaborating with municipalities in El Paso County to make capacity upgrades to existing irrigation drain infrastructure to mitigate flooding while facilitating the capture and reuse of stormwater from local storm events. Stormwater capture and reuse would lead to the development of a new water source for EPCWID #1. Additional studies are needed to determine the quantity and quality of the stormwater that can be captured and the upgrades that are necessary for reuse. EPCWID #1 intends to pursue a mixture of funding options to develop stormwater capture and reuse infrastructure, such as any programs resulting from flood-related legislation passed by the 86th Texas Legislature, including Senate Bill (SB)7, SB 8, SB 500, and House Joint Resolution 4.

Quantity, Reliability, and Cost - The primary benefit of this strategy is allowing for increased delivery efficiency in the canal delivery system after diversion from the river. Previous studies of this project have estimated that the project could provide 6,500 acre-feet of water per year. However, there may be some years where the strategy could provide more or less water, depending on available river supplies and the amount of excess water in the canal. The total capital cost of approximately $13.5 million and supply of 6,500 acre-feet per year developed from this project is equally split between EPW and the EPCWID#1 ($6,750,000 and 3,250 acre-feet per year each).

E-44 New Wasteway 32 River Diversion Pumping Plan

EPCWID #1 is planning to develop a new diversion point at the Rio Grande at the El Paso Upper Valley. The new diversion pint will make irrigation water deliveries to agricultural water users via the La Union East Canal more efficient. In collaboration with EPW, the new diversion pint will allow the delivery of surface water to the Upper Valley Water Treatment Plant. The details for collaboration between EPCWID #1 and EPW for this option have yet to be determined and are outside the scope of regional water planning.

Diversions for irrigation water deliveries in the El Paso Upper Valley are currently made in collaboration with Elephant butte Irrigation District at the Mesilla Dam near Las Cruces, New Mexico. Water for EPCWID #1 is diverted at Mesilla Dam into the Westside Canal and conveyed approximately 20 miles to the heading of the La Union East and West canals and near the Rio Grande Project Wasteway 32. This Wasteway canal conveys bypass water from the La Union East Canal to the Rio Grande.

The proposed conversion of Wasteway 32 into a diversion point on the Rio Grande will reduce the amount of water lost to seepage in the Westside Canal and provide EPCWID #1 and EPW access to surface water during times when no water is or can be diverted at Mesilla Dam.

Portions of the project are already in progress, including concrete lining sections of the La Union East Canal and making sediment control upgrades at Wasteway 32. Additional costs for the Wasteway 32 La Union East River Pumping Plant are included as part of this water management strategy. Further agreements and possible re-routing may be required for surface water deliveries to the Upper Valley Water Treatment Plant.

Quantity, Reliability, and Cost – The primary benefit of this strategy is to increase the resiliency of existing supplies of water, reduction to seepage losses, and increased flexibility in operating the Rio Grande Project. The estimated total capital cost of this project is approximately $4,055,887 and will deliver approximately 5,000 acre-feet per year additional water supply as a result of delivery efficiencies.

5A-12 WATER MANAGEMENT STRATEGIES FOR EL PASO COUNTY MANUFACTURING

El Paso County Manufacturing entities have historically purchased a portion of their water supply from EPW. This strategy provides for the purchase of additional water supplies from EPWU to meet their projected future supply needs. Manufacturing shortages in El Paso County is projected at 8,841 acre-feet per year in 2020; increasing to 15,050 acre-feet per year by 2070. The following water management strategy is recommended to enhance the Manufacturing sector's future water supply availability:

- Manufacturing Conservation
- (E-46) Purchase water from El Paso Water

Manufacturing Conservation

Most groundwater used for manufacturing in El Paso County is for petroleum refining. Upgrading from a wet cooling tower to a hybrid water/air cooling tower minimizes loss by evaporation and required make-up water. The change of the cooling water system minimizes the lost by evaporation, entrainment and purge and as consequence to minimize the fresh water (make-up water) consumption. To minimize waste, cooling tower blowdown can be treated. Thus, depending on the treated effluent quality, it can be recycled to the cooling tower or to another purpose such as fired fighting or service water.

Maximizing cooling tower cycles offers many benefits in the way it reduces water consumption, minimizes waste generation, decreases chemical treatment requirements, and diminishes overall operating costs. Cooling tower cycles can be maximized in a variety of ways. These include pH adjustment, chemical scale inhibitors, and pretreatment of the tower make-up water. Potential cost savings vary from plant to plant, depending on the cost of fresh water, waste disposal costs, chemical treatment dosages, and energy. Nevertheless, in addition to the environmental, health, and safety improvements, some studies show that the return on investment for improving cooling tower efficiency is typically less than one year.

E-46 Purchase Water from El Paso Water (EPW)

This strategy assumes that El Paso County Manufacturing entities would purchase an additional 860 acre-feet of water per year from EPW starting in 2030 at a cost of approximately $1,220 per acre-foot.

Quantity, Reliability and Cost -The total annual cost for the water purchase is approximately $1,049,000. In contrast to many other water management strategies, there are no capital costs associated with the purchase EPW water strategies. The purchased supply is reliant on EPW maintaining its blended water supply and implementation of its Integrated Strategies (5A.4).

5A-13 WATER MANAGEMENT STRATEGIES FOR EL PASO COUNTY MINING

El Paso County Mining entities purchase a portion of their water supply from EPWU; however, much of the water needs for mining operations are self-supplied from private/company water wells. Projected Mining water supply shortages in El Paso County begin in 2020 with a 1,926 acre-feet per year deficit; decreasing to 1,792 acre-feet per year by 2070. The following water management strategies is recommended to enhance the Mining industry's future water supply availability:

- Mining Conservation
- (E-48) Additional groundwater wells in the Hueco-Mesilla Bolson Aquifer

Mining Conservation

Mining groundwater use in Far West Texas is primarily associated with oil and gas production. Water is needed for well drilling activities, formation fracing, and sand (proppant) mining plants. The FWTWPG encourages the use of alternative water sources when and where it is economically feasible to do so. For conservation of freshwater resources associated with fracing, on-site treatment of produced and/or flowback water allows for reuse of the water stream. There are numerous third-party vendors who offer mobile produced water recycling systems.

In 2018, approximately ten percent of fracwater supply in the Permian Basin was recycled produced water. Conservation of 15 percent of El Paso County mining needs in 2020 would reduce mining needs by 278 acre-feet per year.

E-48 Additional Groundwater Wells in the Hueco-Mesilla Bolson Aquifer

The Hueco-Mesilla Bolson Aquifer has been identified as a potential source of water to meet the mining shortages within El Paso County. This Aquifer, a major source of groundwater for cities in El Paso County, extends southeastward from the New Mexico state line in El Paso County to the southern end of the Quitman Mountains in Hudspeth County.

Water from this source is typically good. Fresh to slightly saline water exists in the upper portions of the bolson. Brackish water exists at greater depths and is recommended for mining purposes. This strategy assumes that five new wells will need to be drilled to an average depth of 585 feet below the surface.

Quantity, Reliability, and Cost – The quantity of water from five new wells in this source is expected to be approximately 600 gpm or 4,251 acre-feet per year. The reliability of this supply is medium to high, based on competing demands and water quality issues. Total cost of this project will be approximately $1,208,000.

5A-14 WATER MANAGEMENT STRATEGIES FOR EL PASO COUNTY STEAM ELECTRIC POWER

Steam Electric Power water supply shortages in El Paso County is projected at 7,260 acre-feet per year through 2070. Water supply needs are met partly by EPW's blended source along with obtaining self-supplied groundwater from the Hueco-Mesilla Bolson Aquifer. The following water management strategy is to enhance the reliability of the future water supply availability for steam electric power.

- Steam Electric Power Conservation
- (E-50) Purchase water from El Paso Water

Steam Electric Power Conservation

Upgrading from a wet cooling tower to a hybrid water/air cooling tower minimizes loss by evaporation and required make-up water. The change of the cooling water system minimizes the lost by evaporation, entrainment and purge and as consequence to minimize the fresh water (make-up water) consumption. Dry cooling processes use very little water. However, compared to traditional wet cooling, dry cooling systems have higher upfront and higher operating costs, are less efficient and reliable at warmer temperatures, and demand a larger footprint. Hybrid systems combine wet cooling with dry cooling systems to solve some of these drawbacks, allowing them to function reliably in higher temperatures and a smaller footprint. To minimize waste, cooling tower blowdown can be treated. Thus, depending on the treated effluent quality it can be recycled to the cooling tower or to another purpose such as fired fighting or service water.

Maximizing cooling tower cycles offers many benefits in the way it reduces water consumption, minimizes waste generation, decreases chemical treatment requirements, and diminishes overall operating costs. Cooling tower cycles can be maximized in a variety of ways. These include pH adjustment, chemical scale inhibitors, and pretreatment of the tower make-up water. Potential cost savings vary from plant to plant, depending on the cost of fresh water, waste disposal costs, chemical treatment dosages, and energy. https://www.samcotech.com/how-can-you-reduce-water-used-in-electrical-generation/

E-50 Purchase Water from El Paso Water (EPW)

Quantity, Reliability and Cost - This strategy assumes that El Paso County Steam Electric Power would purchase 7,260 acre-feet of additional water per year from EPW starting in 2020 at a cost of $131 per acre-foot. The total annual cost for the water purchase is approximately $951,000. The purchased supply is reliant on EPW maintaining its blended water supply and implementation of its Integrated Strategies.

5A-15 WATER MANAGEMENT STRATEGIES FOR HUDSPETH COUNTY

5A-15.1 WATER MANAGEMENT STRATEGIES FOR HUDSPETH COUNTY-OTHER (DELL CITY)

Dell City relies on the Bone Spring-Victorio Peak Aquifer for its municipal supply. While the supply availability is adequate, water from the aquifer must be desalinated to make it potable for public drinking water use. Although the supply-demand analysis does not project a future water supply deficit for Dell City, the maintenance and upgrade of the City's desalination facility is recommended to enhance the reliability of its future water supply availability.

E-51 Brackish Groundwater Desalination Facility

Aided by financial assistance from the TWDB, Dell City has plans to replace the City's water treatment facility with a reverse osmosis system. The existing ionic filtration system is outdated and replacement parts are difficult to obtain. In addition, the City's groundwater source exceeds water quality standards for total dissolved solids and fluoride. This strategy incorporates Dell City's funding application from the TWDB Drinking Water State Revolving Fund (DWSRF) for an amount of $244,450. It is assumed that all other necessary infrastructure (e.g., piping, concentrate disposal) is currently in place for the existing facility and will not need to be updated.

Quantity, Reliability, and Cost – This strategy assumes an additional supply of 111 acre-feet of water per year. The reliability of this strategy is high due to the sufficient amounts of brackish groundwater. It is estimated that the total capital cost for this project is $1,636,000.

5A-15.2 WATER MANAGEMENT STRATEGIES FOR HUDSPETH COUNTY-OTHER (SIERRA BLANCA-HUDSPETH COUNTY WCID#1)

The Hudspeth County WCID#1 provides water to the Community of Sierra Blanca and the surrounding area. The Utility is under contract with the Town of Van Horn for delivery of water obtained from wells in the Wild Horse Flat Aquifer north of Van Horn near the airport. Since 1970, Sierra Blanca has drilled several wells near the town in unsuccessful attempts to develop local sources of groundwater. Although the supply-demand analysis does not project a future water supply deficit for the Utility, the following water management strategies are recommended to enhance the reliability of the Utility's future water supply availability:

- (E-52) Public Conservation Education
- (E-53) Replace Water-supply Line from Van Horn
- (E-54) Local Groundwater Well
- (E-55) Groundwater Well NE of Van Horn
- (E-56) Groundwater Well West of Van Horn

E-52 Public Conservation Education

Public information programs, even though they may not be directly related to any equipment or operational change, can result in both short- and long-term water savings. Behavioral changes by customers will only occur if a reasonable yet compelling cause can be presented with sufficient frequency to be recognized and absorbed by the customers. There are many resources that can be consulted to provide insight into implanting effective information programs. Like any marketing or public information program, to be effective, water conservation public information should be planned out and implemented in a consistent and continual manner. A more detailed description of conservation BMPs that might be encouraged is available in TWDB Report 362, Water Conservation Best Management Practices Guide. These BMPs can also be found at: http://www.twdb.texas.gov/conservation/outreach/index.asp

The Hudspeth County WCID#1 (Sierra Blanca) is encouraged to emphasize conservation through public information programs. A total of one percent reduction in demand is anticipated, which would result in a water savings of 1.5 acre-feet by year 2030. The 2030 annual cost for implementing a public information conservation program is estimated at $621.54. It is estimated that the total capital cost for this project is $3,513.

E-53 Replace Water-Supply Line from Van Horn

Water supply generated by the Town of Van Horn is delivered to the Hudspeth County WCID#1 (Sierra Blanca) through an old pipeline that needs major repair or replacement. The Utility estimates a substantial loss along the pipeline resulting in frequent repairs. In 2015, a loss of 7.4 acre-feet or 3.8 percent of the annual flow through the pipeline was recorded. This strategy describes the construction of 40 miles of eight-inch transmission pipeline along existing right of way that will be capable of generating 39 acre-feet of water per year more than was previously achieved. Also included is one pumping station and one booster station to overcome elevation gains.

Quantity, Reliability, and Cost – This strategy assumes an additional supply of 39 acre-feet of water per year. The supply from the Van Horn wellfield is very reliable. It is estimated that the total capital cost for this project is $18,432,000.

E-54 Local Groundwater Well

A new groundwater well located within or adjacent to the Sierra Blanca may provide a local option for additional water supply. The source from which this well would produce is uncertain but is likely from the Diablo Plateau Aquifer. Historically, wells in this area have produced small amounts of brackish groundwater. A well-site assessment is likely necessary for this project. For this strategy, a single well drilled to an estimated depth of 500 feet and completed to public-supply specifications might produce a desired yield of 20 GPM and be operated 12 hours a day. One half mile of 6-inch pipe will connect the supply to the nearest distribution line. As the anticipated supply will likely be brackish in quality, a small wellhead reverse osmosis desalination filtration system.

Quantity, Reliability and Cost - This strategy assumes an additional supply of 16 acre-feet of water per year. The supply from the Diablo Plateau Aquifer well is uncertain. It is estimated that the total capital cost for this project is $940,000.

E-55 Groundwater Well NE of Van Horn

The Hudspeth County WCID#1 is under contract with the Town of Van Horn for delivery of water obtained from wells in the Wild Horse Flat Aquifer north of Van Horn near the airport. One well in this area is currently specifically designated for the District's supply, and there is substantial room for expansion if an additional well is needed to meet increased demand. This strategy describes the construction and completion of one additional well to supply the increased future need for the District. The well is proposed to be 1,500 feet deep with an average pumping capability of 400 GPM. One mile of pipeline is proposed to connect the new well to the main Utility transmission line.

Quantity, Reliability, and Cost – This strategy assumes an additional supply of 39 acre-feet of water per year. The supply from the Van Horn wellfield is very reliable. It is estimated that the total capital cost for this project is $2,132,000.

E-56 Groundwater Well West of Van Horn

One new well is proposed for the Hudspeth County WCID #1 near the Allamoore industrial site along IH10 west of Van Horn. Groundwater availability at this location is uncertain; however, likely host aquifer formations include shallow Eagle Flat alluvium, Permian and Pre-Cambrian limestones and breccia, which for this strategy will be referred to as the Diablo Plateau Aquifer. This strategy describes the construction and completion of one well to supply the increased future need for the District. The well is proposed to be 500 feet deep with an average pumping capability of 100 GPM. A half-mile pipeline is proposed to connect the new well to the main Utility transmission line.

Quantity, Reliability, and Cost – This strategy assumes an additional supply of 39 acre-feet of water per year. The reliability of this strategy is uncertain as few wells have been drilled in this vicinity. It is estimated that the total capital cost for this project is $636,000.

5A-15.3 WATER MANAGEMENT STRATEGIES FOR HUDSPETH COUNTY MINING

Mining water supply shortages in Hudspeth County are projected at 219 acre-feet per year in 2070. Mining water supply needs within the county obtain supplies from both surface and groundwater sources. Surface water such as local supply is commonly used but limited during drought conditions. Groundwater from the Rio Grande Alluvium Aquifer and West Texas Bolsons Aquifer are more reliable sources. The following water management strategy is recommended to enhance the reliability of the future water supply availability for the mining water-supply needs within Hudspeth County:

- Mining Conservation
- (E-58) Additional groundwater well in the West Texas Bolsons (Eagle Flat) Aquifer

Mining Conservation

Mining groundwater use in Far West Texas is primarily associated with oil and gas production. Water is needed for well drilling activities, formation fracing, and sand (proppant) mining plants. The FWTWPG encourages the use of alternative water sources when and where it is economically feasible to do so.

For conservation of freshwater resources associated with fracing, on-site treatment of produced and/or flowback water allows for reuse of the water stream. There are numerous third-party vendors who offer mobile produced water recycling systems.

In 2018, approximately 10 percent of fracwater supply in the Permian Basin was recycled produced water. Conservation of 15 percent of Hudspeth County mining needs in 2020 would reduce mining needs by 29 acre-feet per year.

E-58 Additional Groundwater Well in the West Texas Bolsons (Eagle Flat) Aquifer

The West Texas Bolsons Aquifer has been identified as a potential source of water to meet the mining shortages within Hudspeth County. The Eagle Flat Bolson is situated between the Eagle Mountains along the south-southwest, the Diablo Plateau along the north, and the Carrizo and Van Horn Mountains along the east. Groundwater underlying the Eagle Flat area is not a source of supply for municipalities in Hudspeth County due to water quality and quantity limitations. However, the Eagle Flat is a sufficient source for mining purposes. This strategy assumes that one new well will be drilled to a depth of 375 feet.

Quantity, Reliability, and Cost – The one new well is assumed to produce at a rate of 240 GPM or 219 acre-feet per year. Historical industrial and agricultural use indicates that the West Texas Bolsons Aquifer may be a viable source, with a reliability range medium to high, based on competing demands and water quality issues. Total cost of this project will be approximately $306,000.

5A-16 WATER MANAGEMENT STRATEGIES FOR JEFF DAVIS COUNTY

5A-16.1 WATER MANAGEMENT STRATEGIES FOR FORT DAVIS WSC

Fort Davis Water Supply Corporation (FDWSC) provides water to the Community of Fort Davis and the surrounding area from three wells completed in the Davis Mountains Igneous Aquifer and continues to consider the feasibility of future water well development in surrounding areas. Although the supply-demand analysis does not project a future water supply deficit for the FDWSC, the following water management strategies ae recommended to enhance the reliability of the future water supply availability.

- (E-59) Additional groundwater well in the Igneous Aquifer
- (E-60) Transmission line to connect Fort Davis WSC to Fort Davis Estates

E-59 Additional Groundwater Well – Igneous Aquifer

This strategy assumes that one new well would need to be drilled into the Igneous Aquifer to provide approximately 274 acre-feet per year. The Aquifer is not a single homogeneous aquifer but rather a system of complex water-bearing formations that are in varying degrees of hydrologic communication. Most wells developed are less than 1,000 feet in depth.

This well would be located on the opposite end of the existing storage facility and produce water from approximately 300 feet below the surface. In addition, 500 feet of eight-inch diameter connection pipeline will be necessary to connect to the storage facility. Minimal treatment will be required, such as chlorination disinfection for municipal use.

Quantity, Reliability, and Cost – The quantity and reliability of water from this source is expected to be approximately 274 gpm. Water quality of the aquifer is relatively good and generally meets safe drinking water standards. Minimal advanced treatment will be required for municipal purposes. The reliability of this supply is medium to high, based on competing demands. The total estimated project cost is approximately $584,000.

E-60 Transmission Line to Connect Fort Davis WSC to Fort Davis Estates

FDWSC provides water to the Community of Fort Davis and the surrounding area which includes Fort Davis Estates. FDWSC has plans to construct an additional transmission line to connect FDWSC to the Fort Davis Estates subdivision, which has its own well. This strategy assumes the connection of 20 houses, with a 2-mile, 6-inch diameter transmission pipeline. Conveyance of water would flow both directions depending on peak demand. This pipeline would only be used for emergency purposes to meet the peak demand during summer months. The evaluation does not include additional storage. Funding is expected to be provided solely by Fort Davis WSC.

Quantity, Reliability, and Cost – This strategy would supply 114 acre-feet per year and is considered reliable. The total estimated capital cost for this project is $1,671,000.

5A-17 WATER MANAGEMENT STRATEGIES FOR JEFF DAVIS COUNTY-OTHER (TOWN OF VALENTINE)

The Town of Valentine, a small community in western Jeff Davis County, currently derives its entire water supply from one groundwater well completed in the Ryan Flat portion of the Salt Basin Aquifer, a subdivision of the West Texas Bolson Aquifers. A second well is needed as a supplemental and backup supply for the community. Although the supply-demand analysis does not project a future water-supply deficit for the Town of Valentine, the following water management strategy is recommended to enhance the reliability and security of the community's future water supply availability.

E-61 Additional Groundwater Well in the Ryan Flat Aquifer

This strategy assumes that one new municipal well is needed to provide an additional water supply for the Town of Valentine. This new groundwater well, likewise completed in the Ryan Flat Aquifer, would be located near the existing well and drilled to a depth of approximately 870 feet below the surface. In addition, 500 feet of six-inch diameter connection pipeline will be necessary. Minimal treatment will be required, such as chlorination disinfection for municipal use.

Quantity, Reliability, and Cost – The well is expected to reliably yield approximately 80 gpm and produce 129 acre-feet per year. Water quality of the Aquifer is relatively good and generally meets safe drinking water standards. Minimal advanced treatment will be required for municipal purposes. The total estimated project capital cost is approximately $783,000.

5A-18 WATER MANAGEMENT STRATEGIES FOR PRESIDIO COUNTY

5A-18.1 WATER MANAGEMENT STRATEGIES FOR THE CITY OF PRESIDIO

The City of Presidio is located on the Rio Grande adjacent from Ojinaga, Chihuahua on the U.S.-Mexico Border. The City and many other border residents of Presidio County rely on the West Texas Bolsons – Presidio-Redford Bolson Aquifer for municipal, domestic, livestock and irrigation water supply needs. The following water management strategies are recommended to enhance the reliability of the City's future water supply availability:

- (E-62) Water loss audit and main-line repair
- (E-63) Additional groundwater well in the Presidio Bolson Aquifer

E-62 Water Loss Audit and Main-line Repair

According to the 2015 TWDB Public Water System Water Loss Survey, the City of Presidio had real water losses (as opposed to apparent "paper" losses) of 98 acre-feet in 2015 (14.8%) due to leaking infrastructure. This amount of water loss is the sum of reported breaks and leaks, and unreported loss. The water supply system can reduce water losses and get a more accurate look at water consumption by taking the proper measures to identify and repair old infrastructure and inaccurate water meters. This strategy will provide a savings of only a portion of the total reported loss and assumes that a leak testing program would be implemented prior to possibly replacing portions of the existing leaking pipe.

Quantity, Reliability, and Cost - The strategy assumes 2 miles of 6-inch diameter pipe will be replaced, at a total estimated project capital cost of $509,000. The strategy is estimated to generate a potential savings of 35 acre-feet of water per year in 2020 and up to 45 acre-feet per year by 2070.

E-63 Additional Groundwater Well in the Presidio Bolsons Aquifer

The City of Presidio has plans to develop new water supplies to meet growing water demands within the community. Currently, the Border Environment Cooperation Commission is working with the City of Presidio to develop several improvements to the City's existing water infrastructure. One such project is to extend water services along Highway 67 as far as the airport 5 miles north of town to provide services to Las Pampas Colonia. The new water line will benefit approximately 12 existing residences and an equal number of businesses. This strategy assumes that one new well will be drilled into the West Texas Bolsons Aquifer (Presidio-Redford Bolson) to a depth of 90 feet to generate approximately 150 gpm. The project includes 5 miles of 8-inch diameter transmission pipeline, one pump station, one 50,000-gallon storage tank and minimal treatment such as chlorine disinfection.

Quantity, Reliability, and Cost – The quantity and reliability of water from this source is expected to be approximately 120 acre-feet of water per year. The combined supplies from strategies using water from the Presidio Bolson Aquifer do not exceed the MAG value, indicating there are sufficient supplies for these strategies. Minimal advanced treatment will be required for municipal purposes. The reliability of this supply is low to medium based on finding a good location for a productive well. The total estimated project cost is approximately $5,509,000.

5A-19 WATER MANAGEMENT STRATEGIES FOR TERRELL COUNTY

5A-19.1 WATER MANAGEMENT STRATEGIES FOR TERRELL COUNTY MINING

Mining interests in Terrell County obtains their water from local surface water supplies and from the Edwards-Trinity (Plateau) Aquifer. Local surface water sources are commonly used but limited during drought conditions. The Aquifer source is more reliable and is thus identified as a potential supply to meet the projected mining water supply deficits which are projected at 483 acre-feet per year in 2020; increasing to 586 acre-feet per year by 2030; and then decreasing to 195 acre-feet per year by 2070.

- Mining Conservation
- (E-65) Additional wells in the Edwards-Trinity (Plateau) Aquifer - ALTERNATE

Mining Conservation

Mining groundwater use in Far West Texas is primarily associated with oil and gas production. Water is needed for well drilling activities, formation fracing, and sand (proppant) mining plants. The FWTWPG encourages the use of alternative water sources when and where it is economically feasible to do so.

For conservation of freshwater resources associated with fracing, on-site treatment of produced and/or flowback water allows for reuse of the water stream. There are numerous third-party vendors who offer mobile produced water recycling systems. In 2018, approximately 10 percent of fracwater supply in the Permian Basin was recycled produced water.

E-65 Additional Wells in the Edwards-Trinity (Plateau) Aquifer (ALTERNATE)

The following water management strategy exceeds the current MAG groundwater availability for the Edwards-Trinity (Plateau) Aquifer in Terrell County and therefore cannot be recommended. However, this strategy is included as an "Alternate" strategy designed to be recommended upon a change in DFC and MAG availabilities in future planning cycles, or by a rule modification by the Terrell County Groundwater Conservation District. Should the MAG change in future planning cycles, this strategy will become a recommended strategy. This strategy assumes that six new wells will be drilled to approximately 630 feet below the surface in the general central part of the county.

Quantity, Reliability, and Cost –Six new wells are assumed to supply an additional 470 acre-feet per year. Historical use indicates that the Edwards-Trinity (Plateau) Aquifer may be a viable source and the reliability of this supply is medium to high, based on competing demands and water quality issues. Total cost of this project will be approximately $921,000.

APPENDIX 5B
STRATEGY EVALUATION QUANTIFICATION MATRIX

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STRATEGY EVALUATION QUANTIFICATION MATRIX

The practicality of an implemented water management strategy may be measured in terms of quantity, quality and reliability of water produced and the varying degree of impact (positive or negative) on pre-existing local conditions. The Far West Texas Water Planning Group has adopted a standard procedure for ranking potential water management strategies. Quantitative and qualitative measurements are tabulated in Chapter 5 Tables 5-2 and 5-4. This procedure classifies the strategies using the TWDB's following standard categories developed for regional water planning:

Table 5-2:

- Quantity
- Quality
- Reliability
- Impact of Water, Agricultural, and Natural Resources
- Impact on Ecologically Unique Stream Segments

Table 5-4:

- Environmental Impact
  - Environmental water needs
  - Wildlife habitat
  - Cultural resources
  - Environmental water quality
  - Bays and estuaries

Quantity, Quality and Reliability

Quantity, quality and reliability are quantitatively assessed and assigned a ranking from 1 to 3 as listed in the Table 5B-1below, which shows the correlation between the category and the ranking.

Table 5B-1. Quantity, Quality and Reliability Category Ranking Matrix

Rank	Quantity	Quality	Reliability
1	Meets 100% of shortage	Meets safe drinking water standards	Sustainable
2	Meets 50-99% of shortage	Must be treated or mixed to meet safe drinking water standards	Interruptible
3	Meets < 50% of shortage	Usable for intended non-drinking use only	Un-sustainable

Quantity adequacy is measured as a percent of the volume of water needed to meet the specified water user group's (WUG's) shortage as calculated in Table 4-1 of Chapter 4 that is produced by the water management strategy. Percent volumes are only analyzed for WUGs with projected supply shortages.

Quality adequacy is measured in terms of meeting TCEQ Safe Drinking Water Standards. However, not all strategies are intended for use requiring SDWSs.

Reliability is evaluated based on the expected or potential for the water to be available during drought. Strategies that use water from a source that would not exceed permits or MAGs even during droughts are rated as sustainable. Strategies that use water from a source that is available during normal meteorological conditions but may not be 100% available during drought are rated as interruptible. Strategies in which 100% of the supply cannot be maintained even during normal meteorological conditions are rated as un-sustainable.

Impact on Water, Agricultural and Natural Resources, and Ecologically Unique Stream Segments

Impacts are quantitatively assessed and assigned a ranking from 1 to 5 as listed in Table 5B-2 below, which shows the correlation between the category and the ranking.

Table 5B-2. Strategy Impact Category Ranking Matrix

Rank	Water Resources	Agricultural Resources	Natural Resources	Ecologically Unique Streams
1	Positive	Positive	Positive	Positive
2	None	None	None	None
3	Low	Low	Low	Low
4	Medium	Medium	Medium	Medium
5	High	High	High	High

Water Resources impacts refer to the potential for the implemented strategy to compete for water sources shared with adjacent properties. The matrix ranking depicts the potential range of water-level drawdown induced across property boundaries during the life of the strategy project.

1 Positive - No aquifer drawdown; increased surface water flow

2 None – No new aquifer drawdown; no change to surface water flow

3 Low – <10 feet of aquifer drawdown; < 10% reduction in average surface flows

4 Medium – 10 to 50 feet of aquifer drawdown; 10 to 30% reduction in average surface flows

5 High - > 50 feet of aquifer drawdown; > 30% reduction in surface flows

Agricultural Resources impacts refer to the agricultural economic impact resulting from the loss or gain of water supplies currently in use by the agricultural user as the result of the implementation of a strategy. See Section 1.2.8 in Chapter 1 for a detailed discussion on the Agricultural Resources of Far West Texas.

1 Positive – provides water to agricultural users

2 None – does not impact agricultural supplies

3 Low – reduces agricultural activity by less than 10%

4 Medium – reduces agricultural activity by more than 10%

5 High – water rights use changes from agricultural to some other use thus elimination agricultural activity

Natural Resources impacts are those that impact the terrestrial and aquatic habitat of native plant and animal wildlife, as well as the scenic beauty of the Region that is critical to the tourism industry. See Section 1.2.9 in Chapter 1 for a detailed discussion on the Natural Resources of Far West Texas.

1 Positive – provides water to natural resources

2 None – does not impact natural resources

3 Low – reduces natural resources water supply by less than 10%

4 Medium – reduces natural resources water supply by more than 10%

5 High – reduces natural resources water supply by more than 50%

Ecologically Unique Stream Segments impacts are those that impact the natural habitat of portions of streams that have been identified by the Far West Texas Water Planning Group as "ecologically unique stream segments". See Chapter 8 of both the 2011 and 2016 Far West Texas Water Plan for a location and description of designated stream segments.

1 Positive – provides water to designated stream segments

2 None – does not impact designated stream segments

3 Low – reduces designated stream segment water supply by less than 10%

4 Medium – reduces designated stream segment water supply by more than 10%

5 High – reduces designated stream segment water supply by more than 50%

<u>Environmental Impacts</u>

Environmental impacts are quantitatively assessed and assigned a ranking from 1 to 5 as listed in the Table 5B-3 below, which shows the correlation between the category and the ranking. The Environmental Matrix takes into consideration the following categories;

- Environmental Water Needs
- Wildlife Habitat
- Cultural Resources

- Environmental Water Quality
- Bays and Estuaries

Table 5B-3. Environmental Impact Category Ranting Matrix

<table>
<tr><th>Rank</th><th>Environmental Water Needs</th><th>Wildlife Habitat</th><th>Cultural Resources</th><th>Environmental Water Quality</th><th>Bays and Estuaries</th></tr>
<tr><td>1</td><td>Positive</td><td>Positive</td><td>Positive</td><td>Positive</td><td rowspan="5">Not applicable</td></tr>
<tr><td>2</td><td>No new</td><td>No new</td><td>No new</td><td>No new</td></tr>
<tr><td>3</td><td>Minimal negative</td><td>Minimal negative</td><td>Minimal negative</td><td>Minimal negative</td></tr>
<tr><td>4</td><td>Moderate negative</td><td>Moderate negative</td><td>Moderate negative</td><td>Moderate negative</td></tr>
<tr><td>5</td><td>Significant negative</td><td>Significant negative</td><td>Significant negative</td><td>Significant negative</td></tr>
</table>

Environmental Water Needs impacts refer to how the strategy will impact the area's overall environmental water needs. Water is vital to the environmental health of a region, and so it is important to take into account how strategies will impact the amount of water that will be available to the environment.

1 Positive – additional water will be introduced for environmental use

2 No new – no additional water will be introduced for environmental use

3 Minimal negative – environmental water needs will be reduced by <10%

4 Moderate negative – environmental water needs will be reduced by 10 to 30%

5 Significant negative - environmental water needs will be reduced by >30%

Wildlife Habitat impacts refer to how the strategy will impact the wildlife habitat of the local area. The more area that is impacted due to the implementation of the strategy, the more the area's habitat will be disrupted.

1 Positive – additional habitat area for wildlife use will be created

2 No new – no additional habitat area for wildlife use will be created or destroyed

3 Minimal negative – wildlife habit will be reduced by < 100 acres

4 Moderate negative – wildlife habit will be reduced by 100 to 1,000 acres

5 Significant negative - wildlife habit will be reduced by > 1,000 acres

Cultural Resources impacts refer to how the strategy will impact cultural resources located within the area. Cultural resources are defined as the collective evidence of the past activities and accomplishments of people. Locations, buildings and features with scientific, cultural or historic value are considered to be cultural resources.

1 Positive – cultural resources will be identified and protected

2 No new – no impact will occur to local cultural resources

3 Minimal negative – disturbance to cultural resources will be < 10%

4 Moderate negative – disturbance to cultural resources will be 10 to 20%

5 Significant negative - disturbance to cultural resources will be > 20%

Environmental Water Quality impacts refer to the impact that the implementation of the strategy will have on the local area's natural water quality. Negative impacts could include the introduction of poorer quality water, the reduction of the natural flow of water of native quality source water, or the introduction of detrimental chemical elements into the natural water ways.

1 Positive – water quality of area streams will be enhanced for existing environmental use

2 No new – water quality characteristics of existing environmental habitat will not be changed

3 Minimal negative – water quality characteristics of existing environmental habitat will be negatively altered by < 10%

4 Moderate negative – water quality characteristics of existing environmental habitat will be negatively altered by < 10 to 30%

5 Significant negative - water quality characteristics of existing environmental habitat will be negatively altered by > 30%

Bays and Estuaries - Far West Texas is located too far away from any bays and estuaries of the Texas coastline to have a quantifiable impact. Therefore, this category was assumed to be non-applicable for every strategy.

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CHAPTER 6

REGIONAL WATER PLAN IMPACTS AND CONSISTENCY WITH PROTECTION OF WATER, AGRICULTURAL AND NATURAL RESOURCES

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6 REGIONAL WATER PLAN IMPACTS AND CONSISTENCY WITH PROTECTION OF WATER AGRICULTURAL AND NATURAL RESOURCES

Chapter 6 describes how this *2021 Far West Texas Plan* is consistent with the long-term protection of water resources, agricultural resources, and natural resources that are important to Far West Texas. All planning analyses applied, and recommendations made in the development of this *Plan* honor all existing water rights, contracts, and option agreements; and have no impact on navigation on any of the Region's surface water streams and rivers. Sufficient water management strategy supplies are recommended to meet the identified projected needs of all water user groups (WUGs) in the Region except for the irrigation category in El Paso and Culberson Counties, and for the mining category in El Paso and Terrell Counties. Chapter 4 Table 4-7 provides a list of the anticipated shortages (needs) for these entities.

Third-party social and economic impacts resulting from voluntary redistributions of water, including impacts of moving water from rural and agricultural areas were considered. There are only two strategies (E-16 and E-17) owned by El Paso Water that are impacted by this analysis. Strategy E-16 moves water from currently irrigated farmland in Culberson County to El Paso to El Paso County. This farmland is currently owned by El Paso Water and, therefore, the conversion of use from irrigation to municipal is El Paso Water's decision. Strategy E-17 moves water from the Dell City area of Hudspeth County to El Paso County. El Paso Water is purchasing land and water rights from willing landowners, and therefore the conversion of use from irrigation to municipal is voluntary.

The socioeconomic impact of not meeting water supply needs within the Region is discussed in an analysis report prepared by the Texas Water Development Board and presented in Appendix 6A at the end of this chapter. Based on projected water demands and existing water supplies, the Region identified water needs (potential shortages) that could occur under a repeat of the drought of record for six water use categories (municipal, irrigation, livestock, manufacturing, mining, and steam-electric power). The TWDB then estimated the annual socioeconomic impacts of those needs—if they are not met—for each water use category and as an aggregate for the region.

The report describes that Far West Texas generated more than $35 billion in gross domestic product (2018 dollars) and supported roughly 435,000 jobs in 2016. It is estimated that not meeting the identified water needs in Far West Texas would result in an annually combined lost income impact of approximately $883 million in 2020, increasing to $1.75 billion in 2070. In 2020, the Region would lose approximately 3,600 jobs, and by 2070 job losses would increase to approximately 12,000 if anticipated needs are not mitigated.

6.1 PROTECTION OF WATER RESOURCES

Water resources in Far West Texas as described in Chapter 3 include groundwater in numerous aquifers and surface water occurring in the Rio Grande and Pecos River basins. The numerous springs, which represent a transition point between groundwater and surface water, are also recognized in Chapter 1, Section 1.6 for their major importance.

The first step in achieving long-term water resources protection was in the process of estimating each source's availability. Surface water estimates were developed through a water availability model process (WAM) and are based on the quantity of surface water available to meet existing water rights during a drought-of-record.

Groundwater availability estimates are based on the Modeled Available Groundwater (MAG) volumes that may be produced on an average annual basis to achieve a Desire Future Condition (DFC) as adopted by Groundwater Management Areas (GMAs). Establishing conservative levels of water source availability thus results in less potential of over exploiting the supply.

The next step in establishing the long-term protection of water resources occurs in the water management strategies developed in Chapter 5 to meet potential water supply shortages. Each strategy was evaluated for potential threats to water resources in terms of source depletion (reliability), quality degradation, and impact to environmental habitat.

Water conservation strategies are also recommended for each entity with a supply deficit. Conservation reduces the impact on water supplies by reducing the actual water demand for the supply. Chapter 5 provides an overview of these impact evaluations.

Chapters 5 and 7 contain information and recommendations pertaining to water conservation and drought management practices. When enacted, the conservation practices will diminish water demand, the drought management practices will extend supplies over the stress period, and the land management practices will potentially increase aquifer recharge.

Key parameters of water quality are discussed in Chapter 1 Section 1.8.1, while anticipated water quality of water supplies generated from water management strategies (Chapter 5) are analyzed and reported in Table 5-2. Many of the recommended strategies result in water quality improvement of delivered water. Desalination strategies generate a concentrated waste stream; however, it is disposed of in an appropriate and permitted procedure. No degradation of existing water quality occurs because of recommended strategies.

6.2 PROTECTION OF AGRICULTURAL RESOURCES

Agriculture in Far West Texas, as described in Chapter 1, Sections 1.2.8 and 1.3.2, includes the raising of crops and livestock, as well as a multitude of businesses that support this industry. Water is an absolute necessity to maintaining the agricultural industry and its use represents approximately 65 percent of all the water used in the Region. Many of the communities in the Region depend on various forms of the agricultural industry for a significant portion of their economy. It is thus important to the economic health and way of life in these communities to protect water resources that have historically been used in the support of agricultural activities.

TWDB's socio-economic analysis (Appendix 6A) reports that a projected water shortage in the irrigated agriculture water use category for one or more decades within the water planning horizon (Chapter 4, Table 4-1) only occurs in Culberson and El Paso Counties. No water shortages are projected for Livestock use. Per the TWDB's socio-economic analysis, a negative tax impact was surmised, primarily due to past subsidies from the federal government. Income and job losses are shown in the Table below:

Impacts of Water Shortages on Irrigation

WUG	2020	2030	2040	2050	2060	2070
Income Losses ($ millions) *	$2	$1	$1	$1	$1	$1
Job Losses	26	18	18	18	18	18

* Year 2018 dollars rounded.

The *2021 Far West Texas Water Plan* provides irrigation strategy recommendations in Chapter 5 that address water conservation management practices. If implemented, these practices will result in reduced water application per acre irrigated. Also, non-agricultural strategies provided in Chapter 5 include an analysis of potential impact to agricultural interests.

An interim project was performed in 2009 to evaluate the effectiveness of previously recommended irrigation practices. A summary of this report titled " Evaluation of Irrigation Efficiency Strategies for Far West Texas: Feasibility, Water Savings and Cost Considerations" is available on the Rio Grande COG web site at http://www.riocog.org.

6.3 PROTECTION OF NATURAL RESOURCES

The Far West Texas Water Planning Group has adopted a stance toward the protection of natural resources. Natural resources are defined in Chapter 1, Section 1.2.9 as including terrestrial and aquatic habitats that support a diverse environmental community as well as provide recreational and economic opportunities. Environmental and recreational water needs are discussed in Chapter 2, Section 2.3. Chapter 8 describes recommended ecologically unique river and stream segments.

The protection of natural resources is closely linked with the protection of water resources as discussed in Section 6.1 above. Where possible, the methodology used to assess groundwater source availability is based on not significantly lowering water levels to a point where spring flows might be impacted. Thus, the intention to protect surface flows is directly related to those natural resources that are dependent on surface water sources or spring flows for their existence.

Environmental impacts were evaluated in the consideration of strategies to meet water-supply deficits. Chapter 5 provides a comparative analysis of all selected strategies. Of prime consideration was whether a strategy potentially could diminish the quantity of water currently existing in the natural environment and if a strategy could impact water quality to a level that would be detrimental to animals and plants that naturally inhabit the area under consideration.

The Far West Texas Water Planning Group continues to recommend as "Ecologically Unique River and Stream Segments" three streams that lie within the boundaries of State-managed properties, four within National Park boundaries, and specified streams managed by the Texas Nature Conservancy. A quantitative analysis conducted to assess potential impacts of the *Plan* on these segments found that all recommended strategies listed in Chapter 5 have no influence on water resources in the vicinity of these segments. Although the Planning Group chooses to respect the privacy of private lands by not recommending stream segments on these properties, the Group recognizes and applauds the conservation work that is undertaken daily by the majority of these private landowners.

6.4 PROTECTION OF PUBLIC HEALTH AND SAFETY

The public health and safety of meeting municipal water supply needs is of significant concern of the PRWPG in preparing this *2021 Plan*. Sufficient water management strategy supplies are recommended in this *2021 Plan* to meet the identified projected needs of all municipal water user groups (WUGs) in the Region. The only unmet needs occur for irrigation and mining categories, which do not pose a health and safety concern on the public.

- Culberson and El Paso County Irrigation
- El Paso and Terrell County Mining

Chapter 5 Section 5.2.8 discusses the cause and entities impacted by the non-municipal unmet needs in the Region. The FWTWPG does not anticipate amending the *2021 Plan* to address unmet needs but is prepared to do so if conditions cause a WUG to request such a change.

APPENDIX 6A
SOCIOECONOMIC IMPACT OF UNMET WATER NEEDS

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Socioeconomic Impacts of Projected Water Shortages for the Far West Texas (Region E) Regional Water Planning Area

Prepared in Support of the 2021 Region E Regional Water Plan

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Texas Water Development Board

November 2019

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Executive Summary

Evaluating the social and economic impacts of not meeting identified water needs is a required analysis in the regional water planning process. The Texas Water Development Board (TWDB) estimates these impacts for regional water planning groups (RWPGs) and summarizes the impacts in the state water plan. The analysis presented is for the Far West Texas Regional Water Planning Group (Region E).

Based on projected water demands and existing water supplies, Region E identified water needs (potential shortages) that could occur within its region under a repeat of the drought of record for six water use categories (irrigation, livestock, manufacturing, mining, municipal and steam-electric power). The TWDB then estimated the annual socioeconomic impacts of those needs—if they are not met—for each water use category and as an aggregate for the region.

This analysis was performed using an economic impact modeling software package, IMPLAN (Impact for Planning Analysis), as well as other economic analysis techniques, and represents a snapshot of socioeconomic impacts that may occur during a single year repeat of the drought of record with the further caveat that no mitigation strategies are implemented. Decade specific impact estimates assume that growth occurs, and future shocks are imposed on an economy at 10-year intervals. The estimates presented are not cumulative (i.e., summing up expected impacts from today up to the decade noted), but are simply snapshots of the estimated annual socioeconomic impacts should a drought of record occur in each particular decade based on anticipated water supplies and demands for that same decade.

For regional economic impacts, income losses and job losses are estimated within each planning decade (2020 through 2070). The income losses represent an approximation of gross domestic product (GDP) that would be foregone if water needs are not met.

The analysis also provides estimates of financial transfer impacts, which include tax losses (state, local, and utility tax collections); water trucking costs; and utility revenue losses. In addition, social impacts are estimated, encompassing lost consumer surplus (a welfare economics measure of consumer wellbeing); as well as population and school enrollment losses.

IMPLAN data reported that Region E generated close to $35 billion in GDP (2018 dollars) and supported roughly 435,000 jobs in 2016. Region E estimated total population was approximately 863,000 in 2016.

It is estimated that not meeting the identified water needs in Region E would result in an annually combined lost income impact of approximately $883 million in 2020, increasing to $1.75 billion in 2070 (Table ES-1). In 2020, the region would lose approximately 3,600 jobs, and by 2070 job losses would increase to approximately 12,000 if anticipated needs are not mitigated.

All impact estimates are in year 2018 dollars and were calculated using a variety of data sources and tools including the use of a region-specific IMPLAN model, data from TWDB annual water use estimates, the U.S. Census Bureau, Texas Agricultural Statistics Service, and the Texas Municipal League.

Table ES-1 Region E socioeconomic impact summary

Regional Economic Impacts	2020	2030	2040	2050	2060	2070
Income losses ($ millions)*	$883	$1,143	$1,287	$1,386	$1,538	$1,753
Job losses	3,635	5,443	6,606	7,592	9,422	11,989
Financial Transfer Impacts	**2020**	**2030**	**2040**	**2050**	**2060**	**2070**
Tax losses on production and imports ($ millions)*	$58	$80	$93	$103	$118	$139
Water trucking costs ($ millions)*	$-	$-	$-	$-	$-	$-
Utility revenue losses ($ millions)*	$11	$21	$31	$60	$93	$123
Utility tax revenue losses ($ millions)*	$0	$0	$1	$1	$2	$2
Social Impacts	**2020**	**2030**	**2040**	**2050**	**2060**	**2070**
Consumer surplus losses ($ millions)*	$3	$15	$40	$79	$133	$201
Population losses	667	999	1,213	1,394	1,730	2,201
School enrollment losses	128	191	232	267	331	421

* Year 2018 dollars, rounded. Entries denoted by a dash (-) indicate no estimated economic impact. Entries denoted by a zero ($0) indicate estimated income losses less than $500,000.

1 Introduction

Water shortages during a repeat of the drought of record would likely curtail or eliminate certain economic activity in businesses and industries that rely heavily on water. Insufficient water supplies could not only have an immediate and real impact on the regional economy in the short term, but they could also adversely and chronically affect economic development in Texas. From a social perspective, water supply reliability is critical as well. Shortages could disrupt activity in homes, schools and government, and could adversely affect public health and safety. For these reasons, it is important to evaluate and understand how water supply shortages during drought could impact communities throughout the state.

As part of the regional water planning process, RWPGs must evaluate the social and economic impacts of not meeting water needs (31 Texas Administrative Code §357.33 (c)). Due to the complexity of the analysis and limited resources of the planning groups, the TWDB has historically performed this analysis for the RWPGs upon their request. Staff of the TWDB's Water Use, Projections, & Planning Division designed and conducted this analysis in support of Region E, and those efforts for this region as well as the other 15 regions allow consistency and a degree of comparability in the approach.

This document summarizes the results of the analysis and discusses the methodology used to generate the results. Section 1 provides a snapshot of the region's economy and summarizes the identified water needs in each water use category, which were calculated based on the RWPG's water supply and demand established during the regional water planning process. Section 2 defines each of ten impact assessment measures used in this analysis. Section 3 describes the methodology for the impact assessment and the approaches and assumptions specific to each water use category (i.e., irrigation, livestock, manufacturing, mining, municipal, and steam-electric power). Section 4 presents the impact estimates for each water use category with results summarized for the region as a whole. Appendix A presents a further breakdown of the socioeconomic impacts by county.

1.1 Regional Economic Summary

The Region E Regional Water Planning Area generated close to $35 billion in gross domestic product (2018 dollars) and supported roughly 435,000 jobs in 2016, according to the IMPLAN dataset utilized in this socioeconomic analysis. This activity accounted for approximately 2 percent of the state's total gross domestic product of 1.73 trillion dollars for the year based on IMPLAN. Table 1-1 lists all economic sectors ranked by the total value-added to the economy in Region E. The real estate, manufacturing, and retail trade sectors generated close to 25 percent of the region's total value-added and were also significant sources of tax revenue. The top employers in the region were in the public administration, retail trade, and health care sectors. Region E's estimated total population was approximately 863,000 in 2016, comprising 3 percent of the state's total.

This represents a snapshot of the regional economy as a whole, and it is important to note that not all economic sectors were included in the TWDB socioeconomic impact analysis. Data considerations prompted use of only the more water-intensive sectors within the economy because damage estimates could only be calculated for those economic sectors which had both reliable income and water use estimates.

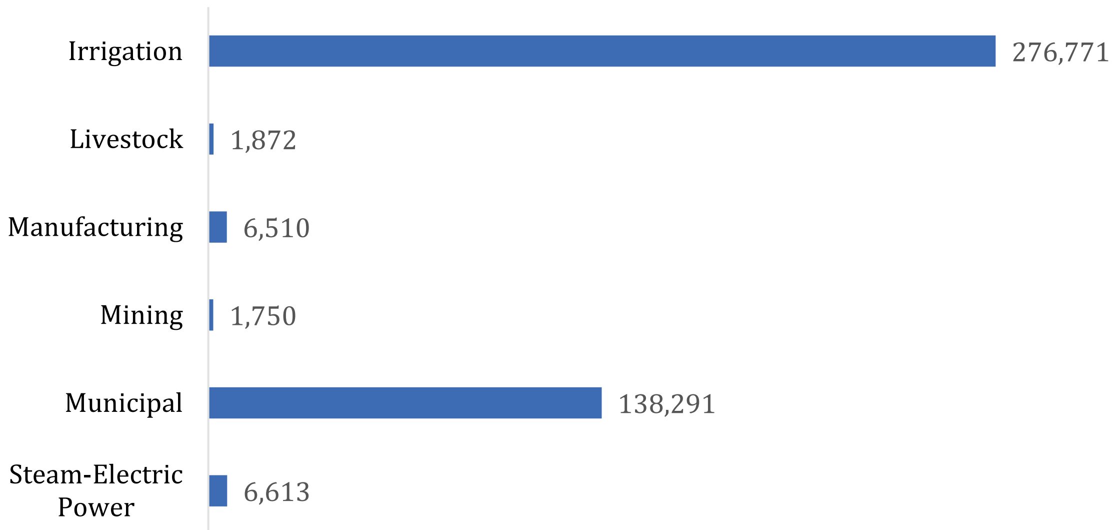
Table 1-1 Region E regional economy by economic sector*

Economic sector	Value-added ($ millions)	Tax ($ millions)	Jobs
Public Administration	$10,871.7	$(105.1)	101,104
Real Estate and Rental and Leasing	$3,358.3	$514.2	15,728
Manufacturing	$2,628.6	$88.5	18,922
Retail Trade	$2,518.5	$648.9	46,183
Health Care and Social Assistance	$2,245.4	$29.6	45,413
Wholesale Trade	$1,907.6	$420.0	14,273
Transportation and Warehousing	$1,708.2	$53.0	21,793
Information	$1,398.5	$479.4	5,131
Professional, Scientific, and Technical Services	$1,285.7	$43.3	17,931
Accommodation and Food Services	$1,257.6	$220.7	37,186
Administrative and Support and Waste Management and Remediation Services	$1,196.6	$35.8	31,879
Construction	$1,182.7	$29.1	26,328
Finance and Insurance	$936.0	$74.6	15,900
Other Services (except Public Administration)	$870.7	$106.9	20,143
Utilities	$806.7	$160.1	1,572
Arts, Entertainment, and Recreation	$128.0	$34.8	5,220
Management of Companies and Enterprises	$113.4	$5.4	1,914
Agriculture, Forestry, Fishing and Hunting	$105.8	$4.0	2,929
Educational Services	$104.1	$5.2	3,959
Mining, Quarrying, and Oil and Gas Extraction	$64.7	$39.3	1,171
Grand Total	$34,688.8	$2,887.5	434,680

*Source: 2016 IMPLAN for 536 sectors aggregated by 2-digit NAICS (North American Industry Classification System)

While municipal and manufacturing sectors led the region in economic output, the majority (64 percent) of water use in 2016 occurred in irrigated agriculture. In fact, more than 3 percent of the state's irrigation water use occurred within Region E. Figure 1-1 illustrates Region E's breakdown of the 2016 water use estimates by TWDB water use category.

Figure 1-1 Region E 2016 water use estimates by water use category (in acre-feet)



Source: TWDB Annual Water Use Estimates (all values in acre-feet)

1.2 Identified Regional Water Needs (Potential Shortages)

As part of the regional water planning process, the TWDB adopted water demand projections for water user groups (WUG) in Region E with input from the planning group. WUG-level demand projections were established for utilities that provide more than 100 acre-feet of annual water supply, combined rural areas (designated as county-other), and county-wide water demand projections for five non-municipal categories (irrigation, livestock, manufacturing, mining and steam-electric power). The RWPG then compared demands to the existing water supplies of each WUG to determine potential shortages, or needs, by decade.

Table 1-2 summarizes the region's identified water needs in the event of a repeat of the drought of record. Demand management, such as conservation, or the development of new infrastructure to increase supplies, are water management strategies that may be recommended by the planning group to address those needs. This analysis assumes that no strategies are implemented, and that the identified needs correspond to future water shortages. Note that projected water needs generally increase over time, primarily due to anticipated population growth, economic growth, or declining supplies. To provide a general sense of proportion, total projected needs as an overall percentage of total demand by water use category are also presented in aggregate in Table 1-2. Projected needs for individual water user groups within the aggregate can vary greatly and may reach 100% for a given WUG and water use category. A detailed summary of water needs by WUG and county appears in Chapter 4 of the 2021 Region E Regional Water Plan.

Table 1-2 Regional water needs summary by water use category *

Water Use Category		2020	2030	2040	2050	2060	2070
Irrigation	water needs (acre-feet per year)	16,903	13,375	13,375	13,375	13,375	13,375
	% of the category's total water demand	5%	4%	4%	4%	4%	4%
Livestock	water needs (acre-feet per year)	-	-	-	-	-	-
	% of the category's total water demand	0%	0%	0%	0%	0%	0%
Manufacturing	water needs (acre-feet per year)	-	860	860	860	860	860
	% of the category's total water demand	0%	11%	11%	11%	11%	11%
Mining	water needs (acre-feet per year)	2,530	3,223	3,840	4,407	5,038	5,796
	% of the category's total water demand	32%	36%	40%	44%	49%	54%
Municipal**	water needs (acre-feet per year)	4,102	8,061	11,815	24,605	38,953	52,666
	% of the category's total water demand	3%	5%	7%	13%	19%	24%
Steam-electric power	water needs (acre-feet per year)	7,260	7,260	7,260	7,260	7,260	7,260
	% of the category's total water demand	69%	69%	69%	69%	69%	69%
Total water needs (acre-feet per year)		**30,795**	**32,779**	**37,150**	**50,507**	**65,486**	**79,957**

*Entries denoted by a dash (-) indicate no identified water need for a given water use category.
** Municipal category consists of residential and non-residential (commercial and institutional) subcategories.

2 Impact Assessment Measures

A required component of the regional and state water plans is to estimate the potential economic and social impacts of potential water shortages during a repeat of the drought of record. Consistent with previous water plans, ten impact measures were estimated and are described in Table 2-1.

Table 2-1 Socioeconomic impact analysis measures

Regional economic impacts	Description
Income losses - value-added	The value of output less the value of intermediate consumption; it is a measure of the contribution to gross domestic product (GDP) made by an individual producer, industry, sector, or group of sectors within a year. Value-added measures used in this report have been adjusted to include the direct, indirect, and induced monetary impacts on the region.
Income losses - electrical power purchase costs	Proxy for income loss in the form of additional costs of power as a result of impacts of water shortages.
Job losses	Number of part-time and full-time jobs lost due to the shortage. These values have been adjusted to include the direct, indirect, and induced employment impacts on the region.
Financial transfer impacts	**Description**
Tax losses on production and imports	Sales and excise taxes not collected due to the shortage, in addition to customs duties, property taxes, motor vehicle licenses, severance taxes, other taxes, and special assessments less subsidies. These values have been adjusted to include the direct, indirect and induced tax impacts on the region.
Water trucking costs	Estimated cost of shipping potable water.
Utility revenue losses	Foregone utility income due to not selling as much water.
Utility tax revenue losses	Foregone miscellaneous gross receipts tax collections.
Social impacts	**Description**
Consumer surplus losses	A welfare measure of the lost value to consumers accompanying restricted water use.
Population losses	Population losses accompanying job losses.
School enrollment losses	School enrollment losses (K-12) accompanying job losses.

2.1 Regional Economic Impacts

The two key measures used to assess regional economic impacts are income losses and job losses. The income losses presented consist of the sum of value-added losses and the additional purchase costs of electrical power.

Income Losses - Value-added Losses

Value-added is the value of total output less the value of the intermediate inputs also used in the production of the final product. Value-added is similar to GDP, a familiar measure of the productivity of an economy. The loss of value-added due to water shortages is estimated by input-output analysis using the IMPLAN software package, and includes the direct, indirect, and induced monetary impacts on the region. The indirect and induced effects are measures of reduced income as well as reduced employee spending for those input sectors which provide resources to the water shortage impacted production sectors.

Income Losses - Electric Power Purchase Costs

The electrical power grid and market within the state is a complex interconnected system. The industry response to water shortages, and the resulting impact on the region, are not easily modeled using traditional input/output impact analysis and the IMPLAN model. Adverse impacts on the region will occur and are represented in this analysis by estimated additional costs associated with power purchases from other generating plants within the region or state. Consequently, the analysis employs additional power purchase costs as a proxy for the value-added impacts for the steam-electric power water use category, and these are included as a portion of the overall income impact for completeness.

For the purpose of this analysis, it is assumed that power companies with insufficient water will be forced to purchase power on the electrical market at a projected higher rate of 5.60 cents per kilowatt hour. This rate is based upon the average day-ahead market purchase price of electricity in Texas that occurred during the recent drought period in 2011. This price is assumed to be comparable to those prices which would prevail in the event of another drought of record.

Job Losses

The number of jobs lost due to the economic impact is estimated using IMPLAN output associated with each TWDB water use category. Because of the difficulty in predicting outcomes and a lack of relevant data, job loss estimates are not calculated for the steam-electric power category.

2.2 Financial Transfer Impacts

Several impact measures evaluated in this analysis are presented to provide additional detail concerning potential impacts on a portion of the economy or government. These financial transfer impact measures include lost tax collections (on production and imports), trucking costs for imported water, declines in utility revenues, and declines in utility tax revenue collected by the state. These measures are not solely adverse, with some having both positive and negative impacts. For example, cities and residents would suffer if forced to pay large costs for trucking in potable water. Trucking firms, conversely, would benefit from the transaction. Additional detail for each of these measures follows.

Tax Losses on Production and Imports

Reduced production of goods and services accompanying water shortages adversely impacts the collection of taxes by state and local government. The regional IMPLAN model is used to estimate reduced tax collections associated with the reduced output in the economy. Impact estimates for this measure include the direct, indirect, and induced impacts for the affected sectors.

Water Trucking Costs

In instances where water shortages for a municipal water user group are estimated by RWPGs to exceed 80 percent of water demands, it is assumed that water would need to be trucked in to support basic consumption and sanitation needs. For water shortages of 80 percent or greater, a fixed, maximum of $35,000[1] per acre-foot of water applied as an economic cost. This water trucking cost was utilized for both the residential and non-residential portions of municipal water needs.

Utility Revenue Losses

Lost utility income is calculated as the price of water service multiplied by the quantity of water not sold during a drought shortage. Such estimates are obtained from utility-specific pricing data provided by the Texas Municipal League, where available, for both water and wastewater. These water rates are applied to the potential water shortage to estimate forgone utility revenue as water providers sold less water during the drought due to restricted supplies.

Utility Tax Losses

Foregone utility tax losses include estimates of forgone miscellaneous gross receipts taxes. Reduced water sales reduce the amount of utility tax that would be collected by the State of Texas for water and wastewater service sales.

2.3 Social Impacts

Consumer Surplus Losses for Municipal Water Users

Consumer surplus loss is a measure of impact to the wellbeing of municipal water users when their water use is restricted. Consumer surplus is the difference between how much a consumer is

[1] Based on staff survey of water hauling firms and historical data concerning transport costs for potable water in the recent drought in California for this estimate. There are many factors and variables that would determine actual water trucking costs including distance to, cost of water, and length of that drought.

willing and able to pay for a commodity (i.e., water) and how much they actually have to pay. The difference is a benefit to the consumer's wellbeing since they do not have to pay as much for the commodity as they would be willing to pay. Consumer surplus may also be viewed as an estimate of how much consumers would be willing to pay to keep the original quantity of water which they used prior to the drought. Lost consumer surplus estimates within this analysis only apply to the residential portion of municipal demand, with estimates being made for reduced outdoor and indoor residential use. Lost consumer surplus estimates varied widely by location and degree of water shortage.

Population and School Enrollment Losses

Population loss due to water shortages, as well as the associated decline in school enrollment, are based upon the job loss estimates discussed in Section 2.1. A simplified ratio of job and net population losses are calculated for the state as a whole based on a recent study of how job layoffs impact the labor market population.[2] For every 100 jobs lost, 18 people were assumed to move out of the area. School enrollment losses are estimated as a proportion of the population lost based upon public school enrollment data from the Texas Education Agency concerning the age K-12 population within the state (approximately 19%).

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[2] Foote, Andrew, Grosz, Michel, Stevens, Ann. "Locate Your Nearest Exit: Mass Layoffs and Local Labor Market Response." University of California, Davis. April 2015, http://paa2015.princeton.edu/papers/150194. The study utilized Bureau of Labor Statistics data regarding layoffs between 1996 and 2013, as well as Internal Revenue Service data regarding migration, to model the change in the population as the result of a job layoff event. The study found that layoffs impact both out-migration and in-migration into a region, and that a majority of those who did move following a layoff moved to another labor market rather than an adjacent county.

3 Socioeconomic Impact Assessment Methodology

This portion of the report provides a summary of the methodology used to estimate the potential economic impacts of future water shortages. The general approach employed in the analysis was to obtain estimates for income and job losses on the smallest geographic level that the available data would support, tie those values to their accompanying historic water use estimate, and thereby determine a maximum impact per acre-foot of shortage for each of the socioeconomic measures. The calculations of economic impacts are based on the overall composition of the economy divided into many underlying economic sectors. Sectors in this analysis refer to one or more of the 536 specific production sectors of the economy designated within IMPLAN, the economic impact modeling software used for this assessment. Economic impacts within this report are estimated for approximately 330 of these sectors, with the focus on the more water-intensive production sectors. The economic impacts for a single water use category consist of an aggregation of impacts to multiple, related IMPLAN economic sectors.

3.1 Analysis Context

The context of this socioeconomic impact analysis involves situations where there are physical shortages of groundwater or surface water due to a recurrence of drought of record conditions. Anticipated shortages for specific water users may be nonexistent in earlier decades of the planning horizon, yet population growth or greater industrial, agricultural or other sector demands in later decades may result in greater overall demand, exceeding the existing supplies. Estimated socioeconomic impacts measure what would happen if water user groups experience water shortages for a period of one year. Actual socioeconomic impacts would likely become larger as drought of record conditions persist for periods greater than a single year.

3.2 IMPLAN Model and Data

Input-Output analysis using the IMPLAN software package was the primary means of estimating the value-added, jobs, and tax related impact measures. This analysis employed regional level models to determine key economic impacts. IMPLAN is an economic impact model, originally developed by the U.S. Forestry Service in the 1970's to model economic activity at varying geographic levels. The model is currently maintained by the Minnesota IMPLAN Group (MIG Inc.) which collects and sells county and state specific data and software. The year 2016 version of IMPLAN, employing data for all 254 Texas counties, was used to provide estimates of value-added, jobs, and taxes on production for the economic sectors associated with the water user groups examined in the study. IMPLAN uses 536 sector-specific Industry Codes, and those that rely on water as a primary input were assigned to their appropriate planning water user categories (irrigation, livestock, manufacturing, mining, and municipal). Estimates of value-added for a water use category were obtained by summing value-added estimates across the relevant IMPLAN sectors associated with that water use category. These calculations were also performed for job losses as well as tax losses on production and imports.

The adjusted value-added estimates used as an income measure in this analysis, as well as the job and tax estimates from IMPLAN, include three components:

- ***Direct effects*** representing the initial change in the industry analyzed;
- ***Indirect effects*** that are changes in inter-industry transactions as supplying industries respond to reduced demands from the directly affected industries; and,
- ***Induced effects*** that reflect changes in local spending that result from reduced household income among employees in the directly and indirectly affected industry sectors.

Input-output models such as IMPLAN only capture backward linkages and do not include forward linkages in the economy.

3.3 Elasticity of Economic Impacts

The economic impact of a water need is based on the size of the water need relative to the total water demand for each water user group. Smaller water shortages, for example, less than 5 percent, are generally anticipated to result in no initial negative economic impact because water users are assumed to have a certain amount of flexibility in dealing with small shortages. As a water shortage intensifies, however, such flexibility lessens and results in actual and increasing economic losses, eventually reaching a representative maximum impact estimate per unit volume of water. To account for these characteristics, an elasticity adjustment function is used to estimate impacts for the income, tax and job loss measures. Figure 3-1 illustrates this general relationship for the adjustment functions. Negative impacts are assumed to begin accruing when the shortage reaches the lower bound 'b1' (5 percent in Figure 3-1), with impacts then increasing linearly up to the 100 percent impact level (per unit volume) once the upper bound reaches the 'b2' level shortage (40 percent in Figure 3-1).

To illustrate this, if the total annual value-added for manufacturing in the region was \$2 million and the reported annual volume of water used in that industry is 10,000 acre-feet, the estimated economic measure of the water shortage would be \$200 per acre-foot. The economic impact of the shortage would then be estimated using this value-added amount as the maximum impact estimate (\$200 per acre-foot) applied to the anticipated shortage volume and then adjusted by the elasticity function. Using the sample elasticity function shown in Figure 3-1, an approximately 22 percent shortage in the livestock category would indicate an economic impact estimate of 50% of the original \$200 per acre-foot impact value (i.e., \$100 per acre-foot).

Such adjustments are not required in estimating consumer surplus, utility revenue losses, or utility tax losses. Estimates of lost consumer surplus rely on utility-specific demand curves with the lost consumer surplus estimate calculated based on the relative percentage of the utility's water shortage. Estimated changes in population and school enrollment are indirectly related to the elasticity of job losses.

Assumed values for the lower and upper bounds 'b1' and 'b2' vary by water use category and are presented in Table 3-1.

Figure 3-1 Example economic impact elasticity function (as applied to a single water user's shortage)

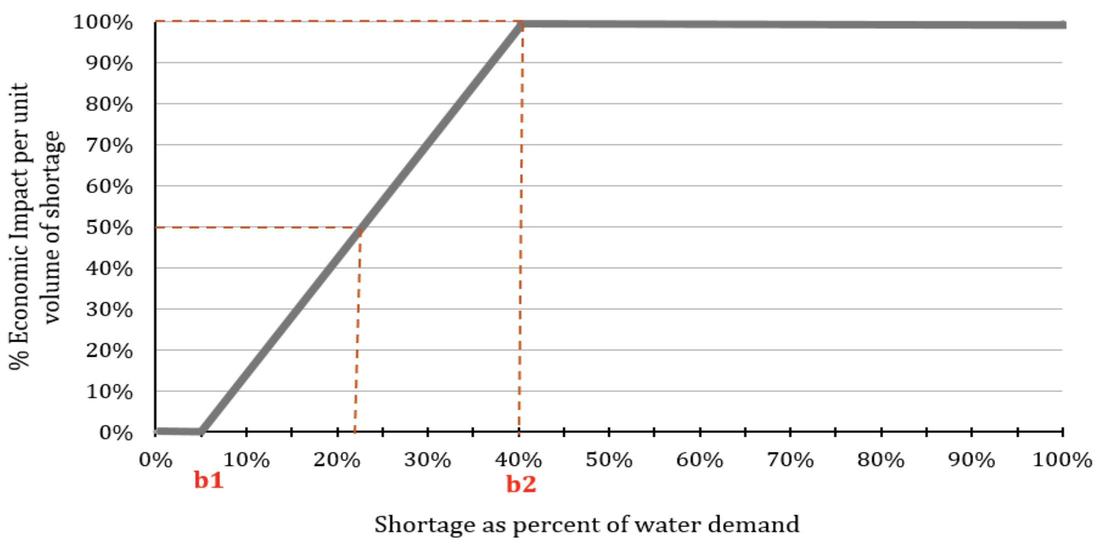

Table 3-1 Economic impact elasticity function lower and upper bounds

Water use category	Lower bound (b1)	Upper bound (b2)
Irrigation	5%	40%
Livestock	5%	10%
Manufacturing	5%	40%
Mining	5%	40%
Municipal (non-residential water intensive subcategory)	5%	40%
Steam-electric power	N/A	N/A

3.4 Analysis Assumptions and Limitations

The modeling of complex systems requires making many assumptions and acknowledging the model's uncertainty and limitations. This is particularly true when attempting to estimate a wide range of socioeconomic impacts over a large geographic area and into future decades. Some of the key assumptions and limitations of this methodology include:

1. The foundation for estimating the socioeconomic impacts of water shortages resulting from a drought are the water needs (potential shortages) that were identified by RWPGs as part of the

regional water planning process. These needs have some uncertainty associated with them but serve as a reasonable basis for evaluating the potential impacts of a drought of record event.

2. All estimated socioeconomic impacts are snapshots for years in which water needs were identified (i.e., 2020, 2030, 2040, 2050, 2060, and 2070). The estimates are independent and distinct "what if" scenarios for each particular year, and water shortages are assumed to be temporary events resulting from a single year recurrence of drought of record conditions. The evaluation assumed that no recommended water management strategies are implemented. In other words, growth occurs and future shocks are imposed on an economy at 10-year intervals, and the resulting impacts are estimated. Note that the estimates presented are not cumulative (i.e., summing up expected impacts from today up to the decade noted), but are simply snapshots of the estimated annual socioeconomic impacts should a drought of record occur in each particular decade based on anticipated water supplies and demands for that same decade.

3. Input-output models such as IMPLAN rely on a static profile of the structure of the economy as it appears today. This presumes that the relative contributions of all sectors of the economy would remain the same, regardless of changes in technology, availability of limited resources, and other structural changes to the economy that may occur in the future. Changes in water use efficiency will undoubtedly take place in the future as supplies become more stressed. Use of the static IMPLAN structure was a significant assumption and simplification considering the 50-year time period examined in this analysis. To presume an alternative future economic makeup, however, would entail positing many other major assumptions that would very likely generate as much or more error.

4. This is not a form of cost-benefit analysis. That approach to evaluating the economic feasibility of a specific policy or project employs discounting future benefits and costs to their present value dollars using some assumed discount rate. The methodology employed in this effort to estimate the economic impacts of future water shortages did not use any discounting methods to weigh future costs differently through time.

5. All monetary values originally based upon year 2016 IMPLAN and other sources are reported in constant year 2018 dollars to be consistent with the water management strategy requirements in the State Water Plan.

6. IMPLAN based loss estimates (income-value-added, jobs, and taxes on production and imports) are calculated only for those IMPLAN sectors for which the TWDB's Water Use Survey (WUS) data was available and deemed reliable. Every effort is made in the annual WUS effort to capture all relevant firms who are significant water users. Lack of response to the WUS, or omission of relevant firms, impacts the loss estimates.

7. Impacts are annual estimates. The socioeconomic analysis does not reflect the full extent of impacts that might occur as a result of persistent water shortages occurring over an extended duration. The drought of record in most regions of Texas lasted several years.

8. Value-added estimates are the primary estimate of the economic impacts within this report. One may be tempted to add consumer surplus impacts to obtain an estimate of total adverse economic impacts to the region, but the consumer surplus measure represents the change to the wellbeing of households (and other water users), not an actual change in the flow of dollars through the economy. The two measures (value-added and consumer surplus) are both valid impacts but ideally should not be summed.

9. The value-added, jobs, and taxes on production and import impacts include the direct, indirect and induced effects to capture backward linkages in the economy described in Section 2.1. Population and school enrollment losses also indirectly include such effects as they are based on the associated losses in employment. The remaining measures (consumer surplus, utility revenue, utility taxes, additional electrical power purchase costs, and potable water trucking costs), however, do not include any induced or indirect effects.

10. The majority of impacts estimated in this analysis may be more conservative (i.e., smaller) than those that might actually occur under drought of record conditions due to not including impacts in the forward linkages in the economy. Input-output models such as IMPLAN only capture backward linkages on suppliers (including households that supply labor to directly affected industries). While this is a common limitation in this type of economic modeling effort, it is important to note that forward linkages on the industries that use the outputs of the directly affected industries can also be very important. A good example is impacts on livestock operators. Livestock producers tend to suffer substantially during droughts, not because there is not enough water for their stock, but because reductions in available pasture and higher prices for purchased hay have significant economic effects on their operations. Food processors could be in a similar situation if they cannot get the grains or other inputs that they need. These effects are not captured in IMPLAN, resulting in conservative impact estimates.

11. The model does not reflect dynamic economic responses to water shortages as they might occur, nor does the model reflect economic impacts associated with a recovery from a drought of record including:
    a. The likely significant economic rebound to some industries immediately following a drought, such as landscaping;
    b. The cost and time to rebuild liquidated livestock herds (a major capital investment in that industry);
    c. Direct impacts on recreational sectors (i.e., stranded docks and reduced tourism); or,
    d. Impacts of negative publicity on Texas’ ability to attract population and business in the event that it was not able to provide adequate water supplies for the existing economy.

12. Estimates for job losses and the associated population and school enrollment changes may exceed what would actually occur. In practice, firms may be hesitant to lay off employees, even in difficult economic times. Estimates of population and school enrollment changes are based on regional evaluations and therefore do not necessarily reflect what might occur on a statewide basis.

13. **The results must be interpreted carefully. It is the general and relative magnitudes of impacts as well as the changes of these impacts over time that should be the focus rather than the absolute numbers.** Analyses of this type are much better at predicting relative percent differences brought about by a shock to a complex system (i.e., a water shortage) than the precise size of an impact. To illustrate, assuming that the estimated economic impacts of a drought of record on the manufacturing and mining water user categories are \$2 and \$1 million, respectively, one should be more confident that the economic impacts on manufacturing are twice as large as those on mining and that these impacts will likely be in the millions of dollars. But one should have less confidence that the actual total economic impact experienced would be \$3 million.

14. The methodology does not capture "spillover" effects between regions – or the secondary impacts that occur outside of the region where the water shortage is projected to occur.

15. The methodology that the TWDB has developed for estimating the economic impacts of unmet water needs, and the assumptions and models used in the analysis, are specifically designed to estimate potential economic effects at the regional and county levels. Although it may be tempting to add the regional impacts together in an effort to produce a statewide result, the TWDB cautions against that approach for a number of reasons. The IMPLAN modeling (and corresponding economic multipliers) are all derived from regional models – a statewide model of Texas would produce somewhat different multipliers. As noted in point 14 within this section, the regional modeling used by TWDB does not capture spillover losses that could result in other regions from unmet needs in the region analyzed, or potential spillover gains if decreased production in one region leads to increases in production elsewhere. The assumed drought of record may also not occur in every region of Texas at the same time, or to the same degree.

4 Analysis Results

This section presents estimates of potential economic impacts that could reasonably be expected in the event of water shortages associated with a drought of record and if no recommended water management strategies were implemented. Projected economic impacts for the six water use categories (irrigation, livestock, manufacturing, mining, municipal, and steam-electric power) are reported by decade.

4.1 Impacts for Irrigation Water Shortages

Two of the seven counties in the region are projected to experience water shortages in the irrigated agriculture water use category for one or more decades within the planning horizon. Estimated impacts to this water use category appear in Table 4-1. Note that tax collection impacts were not estimated for this water use category. IMPLAN data indicates a negative tax impact (i.e., increased tax collections) for the associated production sectors, primarily due to past subsidies from the federal government. However, it was not considered realistic to report increasing tax revenues during a drought of record.

Table 4-1 Impacts of water shortages on irrigation in Region E

Impact measure	2020	2030	2040	2050	2060	2070
Income losses ($ millions)*	$2	$1	$1	$1	$1	$1
Job losses	36	18	18	18	18	18

* Year 2018 dollars, rounded. Entries denoted by a dash (-) indicate no estimated economic impact. Entries denoted by a zero ($0) indicate estimated income losses less than $500,000.

4.2 Impacts for Livestock Water Shortages

None of the seven counties in the region are projected to experience water shortages in the livestock water use category. Estimated impacts to this water use category appear in Table 4-2.

Table 4-2 Impacts of water shortages on livestock in Region E

Impact measure	2020	2030	2040	2050	2060	2070
Income losses ($ millions)*	$-	$-	$-	$-	$-	$-
Jobs losses	-	-	-	-	-	-
Tax losses on production and imports ($ millions)*	$-	$-	$-	$-	$-	$-

* Year 2018 dollars, rounded. Entries denoted by a dash (-) indicate no estimated economic impact. Entries denoted by a zero ($0) indicate estimated income losses less than $500,000.

4.3 Impacts of Manufacturing Water Shortages

Manufacturing water shortages in the region are projected to occur in one of the seven counties in the region for at least one decade of the planning horizon. Estimated impacts to this water use category appear in Table 4-3.

Table 4-3 Impacts of water shortages on manufacturing in Region E

Impacts measure	2020	2030	2040	2050	2060	2070
Income losses ($ millions)*	$-	$41	$41	$41	$41	$41
Job losses	-	270	270	270	270	270
Tax losses on production and Imports ($ millions)*	$-	$3	$3	$3	$3	$3

* Year 2018 dollars, rounded. Entries denoted by a dash (-) indicate no estimated economic impact. Entries denoted by a zero ($0) indicate estimated income losses less than $500,000.

4.4 Impacts of Mining Water Shortages

Mining water shortages in the region are projected to occur in three of the seven counties in the region for one or more decades within the planning horizon. Estimated impacts to this water use type appear in Table 4-4.

Table 4-4 Impacts of water shortages on mining in Region E

Impacts measure	2020	2030	2040	2050	2060	2070
Income losses ($ millions)*	$680	$866	$980	$1,047	$1,133	$1,254
Job losses	3,135	3,970	4,502	4,821	5,221	5,783
Tax losses on production and Imports ($ millions)*	$56	$72	$81	$87	$95	$105

* Year 2018 dollars, rounded. Entries denoted by a dash (-) indicate no estimated economic impact. Entries denoted by a zero ($0) indicate estimated income losses less than $500,000.

4.5 Impacts for Municipal Water Shortages

Two of the seven counties in the region are projected to experience water shortages in the municipal water use category for one or more decades within the planning horizon.

Impact estimates were made for two sub-categories within municipal water use: residential and non-residential. Non-residential municipal water use includes commercial and institutional users, which are further divided into non-water-intensive and water-intensive subsectors including car wash, laundry, hospitality, health care, recreation, and education. Lost consumer surplus estimates were made only for needs in the residential portion of municipal water use. Available IMPLAN and TWDB Water Use Survey data for the non-residential, water-intensive portion of municipal demand allowed these sectors to be included in income, jobs, and tax loss impact estimate.

Trucking cost estimates, calculated for shortages exceeding 80 percent, assumed a fixed, maximum cost of $35,000 per acre-foot to transport water for municipal use. The estimated impacts to this water use category appear in Table 4-5.

Table 4-5 Impacts of water shortages on municipal water users in Region E

Impacts measure	2020	2030	2040	2050	2060	2070
Income losses[1] ($ millions)*	$22	$56	$85	$116	$183	$278
Job losses[1]	464	1,186	1,817	2,483	3,913	5,919
Tax losses on production and imports[1] ($ millions)*	$2	$6	$9	$13	$20	$30
Trucking costs ($ millions)*	$-	$-	$-	$-	$-	$-
Utility revenue losses ($ millions)*	$11	$21	$31	$60	$93	$123
Utility tax revenue losses ($ millions)*	$0	$0	$1	$1	$2	$2

[1] Estimates apply to the water-intensive portion of non-residential municipal water use.
* Year 2018 dollars, rounded. Entries denoted by a dash (-) indicate no estimated economic impact. Entries denoted by a zero ($0) indicate estimated income losses less than $500,000.

4.6 Impacts of Steam-Electric Water Shortages

Steam-electric water shortages in the region are projected to occur in one of the seven counties in the region for one or more decades within the planning horizon. Estimated impacts to this water use category appear in Table 4-6.

Note that estimated economic impacts to steam-electric water users:

- Are reflected as an income loss proxy in the form of estimated additional purchasing costs for power from the electrical grid to replace power that could not be generated due to a shortage;
- Do not include estimates of impacts on jobs. Because of the unique conditions of power generators during drought conditions and lack of relevant data, it was assumed that the industry would retain, perhaps relocating or repurposing, their existing staff in order to manage their ongoing operations through a severe drought.
- Do not presume a decline in tax collections. Associated tax collections, in fact, would likely increase under drought conditions since, historically, the demand for electricity increases during times of drought, thereby increasing taxes collected on the additional sales of power.

Table 4-6 Impacts of water shortages on steam-electric power in Region E

Impacts measure	2020	2030	2040	2050	2060	2070
Income Losses ($ millions)*	$180	$180	$180	$180	$180	$180

* Year 2018 dollars, rounded. Entries denoted by a dash (-) indicate no estimated economic impact. Entries denoted by a zero ($0) indicate estimated income losses less than $500,000.

4.7 Regional Social Impacts

Projected changes in population, based upon several factors (household size, population, and job loss estimates), as well as the accompanying change in school enrollment, were also estimated and are summarized in Table 4-7.

Table 4-7 Region-wide social impacts of water shortages in Region E

Impacts measure	2020	2030	2040	2050	2060	2070
Consumer surplus losses ($ millions)*	$3	$15	$40	$79	$133	$201
Population losses	667	999	1,213	1,394	1,730	2,201
School enrollment losses	128	191	232	267	331	421

* Year 2018 dollars, rounded. Entries denoted by a dash (-) indicate no estimated economic impact. Entries denoted by a zero ($0) indicate estimated income losses less than $500,000.

Appendix A - County Level Summary of Estimated Economic Impacts for Region E

County level summary of estimated economic impacts of not meeting identified water needs by water use category and decade (in 2018 dollars, rounded). Values are presented only for counties with projected economic impacts for at least one decade.
(* Entries denoted by a dash (-) indicate no estimated economic impact)

		Income losses (Million $)*						Job losses					
County	Water Use Category	2020	2030	2040	2050	2060	2070	2020	2030	2040	2050	2060	2070
EL PASO	IRRIGATION	$1.69	$0.82	$0.82	$0.82	$0.82	$0.82	36	18	18	18	18	18
EL PASO	MANUFACTURING	-	$41.35	$41.35	$41.35	$41.35	$41.35	-	270	270	270	270	270
EL PASO	MINING	$386.81	$515.95	$648.86	$792.22	$947.90	$1,124.69	1,773	2,365	2,974	3,631	4,344	5,155
EL PASO	MUNICIPAL	$21.67	$55.51	$85.12	$116.36	$183.41	$277.45	462	1,184	1,815	2,482	3,912	5,917
EL PASO	STEAM ELECTRIC POWER	$179.59	$179.59	$179.59	$179.59	$179.59	$179.59	-	-	-	-	-	-
EL PASO Total		**$589.77**	**$793.23**	**$955.75**	**$1,130.34**	**$1,353.08**	**$1,623.90**	**2,271**	**3,836**	**5,076**	**6,400**	**8,543**	**11,359**
HUDSPETH	MINING	$14.88	$11.75	$13.85	$15.18	$15.86	$16.62	110	87	102	112	117	123
HUDSPETH	MUNICIPAL	$0.07	$0.08	$0.08	$0.08	$0.08	$0.08	1	2	2	2	2	2
HUDSPETH Total		**$14.95**	**$11.83**	**$13.93**	**$15.26**	**$15.94**	**$16.71**	**111**	**89**	**104**	**114**	**119**	**125**
TERRELL	MINING	$278.59	$337.99	$317.23	$239.94	$169.00	$112.47	1,252	1,519	1,426	1,078	759	505
TERRELL Total		**$278.59**	**$337.99**	**$317.23**	**$239.94**	**$169.00**	**$112.47**	**1,252**	**1,519**	**1,426**	**1,078**	**759**	**505**
REGION E Total		**$883.30**	**$1,143.05**	**$1,286.91**	**$1,385.54**	**$1,538.02**	**$1,753.08**	**3,635**	**5,443**	**6,606**	**7,592**	**9,422**	**11,989**

CHAPTER 7

DROUGHT RESPONSE INFORMATION, ACTIVITIES, AND RECOMMENDATIONS

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7 REGIONAL DROUGHT RESPONSE, INFORMATION, ACTIVITES, AND RECOMMENDATIONS

Drought is a frequent and inevitable factor in the climate of Texas. Therefore, it is vital to plan for the effect that droughts will have on the use, allocation and conservation of water in the State. Through the regional water planning process, requirements for drought management planning are found in Title 31 of the Texas Administrative Code (TAC), Part 10, Chapter 357, Subchapter D. Texas Statute reference §357.42 includes requirements regarding drought response information, activities, and recommendations. This chapter examines these specific requirements and identifies drought impacts within the Region.

7.1 DROUGHTS OF RECORD IN FAR WEST TEXAS

The severity of the recent drought significantly impacted the lives of water users, providers and water managers who were hard-pressed to find solutions to critical supply and demand issues. The severity of the impacts varied, but the overriding sense of urgency to create workable strategies and solutions was acknowledged and acted upon Statewide. Therefore, it is critical in this planning cycle to continue to address the impact that drought has had and will have on the future use, allocation and conservation of water in Far West Texas.

There are different types of drought that have been defined in various ways; however, these definitions fall into four primary categories: meteorological, agricultural, hydrological and socioeconomic drought. In the most general sense, drought is a deficiency of precipitation over an extended period, resulting in a water shortage for some activity, group or environmental purpose. The State Drought Preparedness Plan provides more specific and detailed definitions. and is located at the following link:

http://www.txdps.state.tx.us/dem/CouncilsCommittees/droughtCouncil/droughtPrepPlan.pdf.

Meteorological drought is quantified by how dry it is (for example, a rain deficit) compared to normal conditions as well as the duration of the dry period. This is typically a region-specific metric, since factors affecting meteorological drought can vary so much in different regions.

Agricultural drought looks at the effects of meteorological drought in terms of agricultural impacts. For example, evapotranspiration, soil moisture and plant stress are measures of agricultural drought, which account for vulnerability of crops through the various growth stages.

Hydrological drought is measured in terms of effects on surface and subsurface waters, such as reservoir stage and capacity, stream flow or groundwater levels in wells. Hydrological drought is usually defined on a river-basin or watershed scale. Hydrological droughts typically lag behind meteorological and agricultural droughts because it takes more time for the evidence of basin-wide impacts to manifest.

Socioeconomic drought occurs when the demand for an economic product (such as hydroelectric power) exceeds supply due to a weather-related deficit. Typically, demand for a product increases with population growth and per capita consumptions. Supply increases due to efficiency technology and the construction of new water projects. If both are increasing, the rate of change between supply and demand is the key. However, when demand exceeds supply, vulnerability is magnified by water shortages during drought.

Several climatological drought indicators have been formulated to quantify drought. The Palmer Drought Severity Index (PDSI) was developed in 1965 and is currently used by many federal and state agencies. The PDSI is a soil moisture index that works best in relatively large regions with uniform topography that don't experience extreme climate shifts. PDSI values can lag oncoming drought by several months. The TWDB uses the PDSI to monitor State drought conditions, which has values ranging between -6.0 (driest) to 6.0 (wettest). "Extreme drought" conditions have a PDSI between -6.0 and -4.0, and "severe drought" conditions have a PDSI between -3.99 and -3.0. An accumulated area graph of the weekly PDSI categories for the Trans-Pecos region is included as Figure 7-1.

Since 2000, the Trans-Pecos region experienced recurring extreme drought conditions in 2000 through 2004, 2006 through 2008, in 2013 and in 2018. The Trans-Pecos region experienced the longest sustained periods of extreme drought between January 2011 and September 2012.

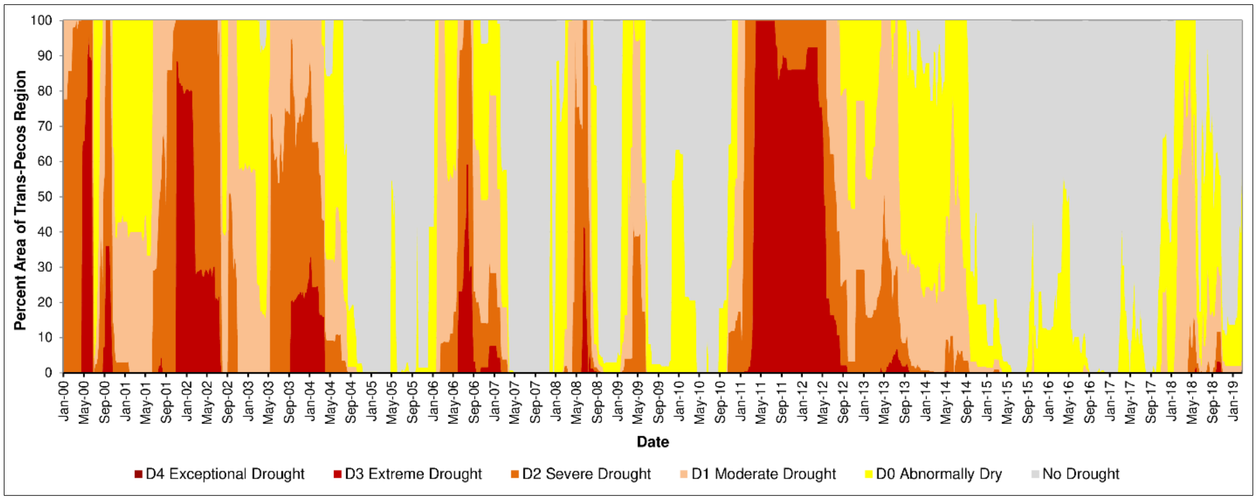

Figure 7-1. Drought in the Texas Trans-Pecos Region, 2000-2018

Source: U.S. Drought Monitor

Far West Texas, including the Trans-Pecos Regions is perennially under drought or near drought conditions compared with more humid areas of the State. Citizens of the Region experience a wide range of weather conditions due to the Region being in the middle latitudes and northwest of the Gulf of Mexico. Although residents of the Region are generally accustomed to these conditions, the low rainfall and the accompanying high levels of evaporation underscore the necessity of developing plans that respond to potential disruptions in the supply of groundwater and surface water caused by drought conditions.

7.1.1 Precipitation Indicator

Average annual precipitation varies from about 8 inches a year in El Paso County to nearly 15 inches in Jeff Davis County, based on NWS cooperator weather station data (Figure 7-2).

Comparing the 1950s DOR and the current drought can be accomplished using historic precipitation, stream flow records, spring discharge, and water level measurements in wells for locations that have accumulated data measurements since the 1940s.

The greatest precipitation impact to the Region comes further north in New Mexico and southern Colorado. Along the Rio Grande lies New Mexico’s largest reservoir, Elephant Butte Reservoir. In terms of Far West Texas’ surface water availability, it is the annual volume of water released from the Elephant Butte that must try to meet a portion of the growing water demands of the Region. However, severe drought had driven the storage levels of the Elephant Butte Reservoir to record lows of less than ten percent full, or 97 feet into the reservoirs “dead pool during the recent drought. This is one of the many problems in a series of drought-related challenges facing the Region. Currently, Elephant Butte Reservoir is 22 percent full, so it has recovered somewhat from the previous drought.

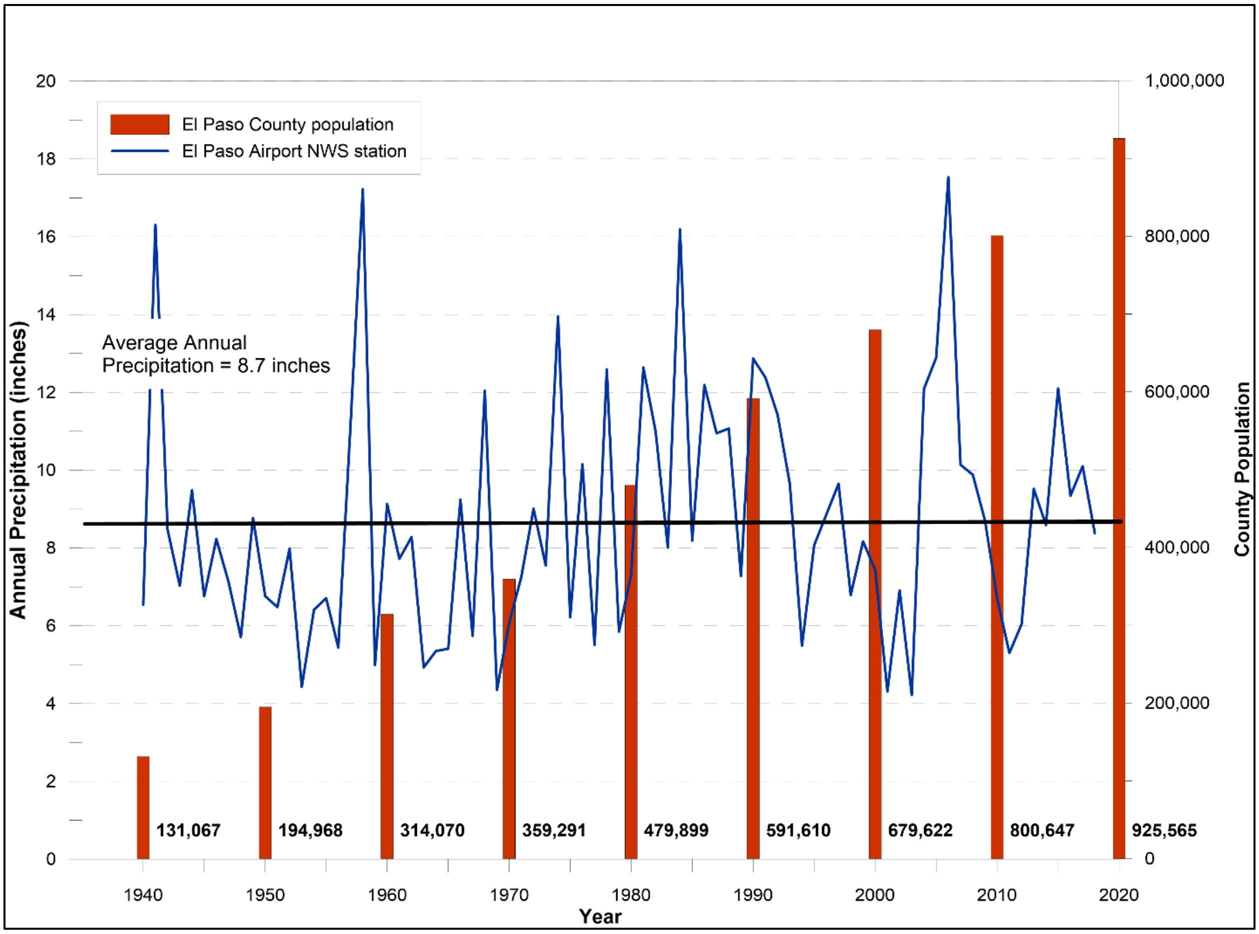

Figure 7-2. Annual Rainfall vs Population, El Paso County, 1940-2012

Source: NOAA NCDC; Texas Almanac

Figure 7-3 presents the storage capacity of Elephant Butte Reservoir from 1915 through 2019. The graph illustrates that the most significant declines in capacity due to drought impacting the reservoir occurred between 1951 and 1957. Recurring cycles of low capacity are evident between 1963 and 1965, 1971 and 1973, 1977 and 1979, 2003 and 2005and since 2012. The longest sustained period of very low capacity occurred between 1953 and 1957.

Although water users located near the Rio Grande are more significantly impacted by precipitation that falls within the upper reaches of the Rio Grande Basin in New Mexico and southern Colorado, this is not the case for water users who are located further from the river. Precipitation in these areas provides important recharge to aquifers that are annually diminished by pumping withdrawals.

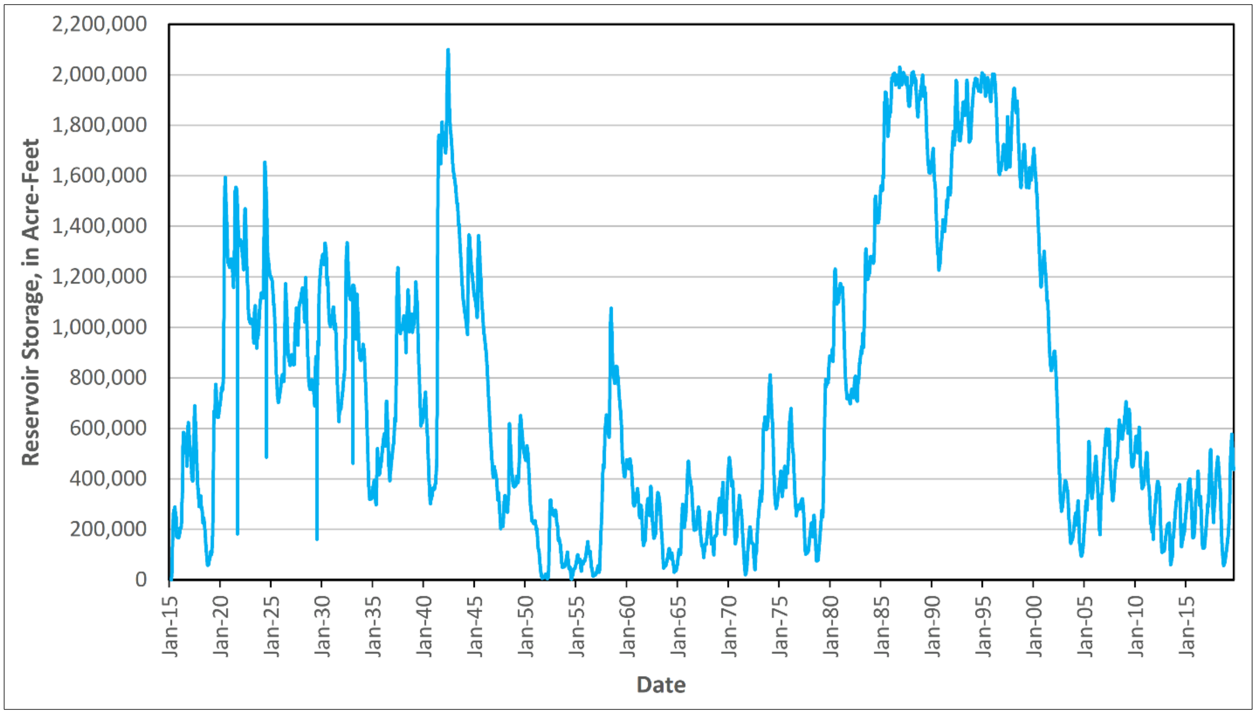

Figure 7-3. Storage Levels for Elephant Butte Reservoir 1915-2019

Source: Water Data for Texas

7.1.2 Stream Flow Indicator

The monitoring of streamflow of a river can generally provide a reliable indication of drought conditions throughout much of the State. However, gaging streamflow of the Rio Grande must be performed with knowledge of other factors that impact the supply of water in the river. Depending on the location of the stream gage, releases from Elephant Butte Reservoir and reservoirs on the Rio Conchos in Mexico have a large influence on streamflow at any given time.

A graph of streamflow at IBWC gaging station 08-374200.00 located on the Rio Grande just below the confluence with the Rio Conchos is included as Figure 7-4. The top graph illustrates peak events; the bottom graph focuses on low flow/no flow events. The construction and filling of Elephant Butte Reservoir accounts for the data gap between 1914 and 1930. The Luis L. Leon Reservoir (on the Rio Conchos) was completed in 1968.

Peak flows since 1900 have decreased after the construction of Elephant Butte Reservoir. The most current extreme peak occurred in 2008. The late spring and summer of 2008 was an abnormally wet season from the monsoonal rainfall over Mexico and southwest Texas (Hurricane Dolly in July, followed by tropical storm Julio in late August followed by tropical storm Lowell in September). The peak flow of 51,206 cfs occurred on September 19, 2008. Levees failed at Presidio, Texas and Ojinaga, Mexico causing extensive, devastating flooding in the area. The levees were designed for 42,000 cfs. Low-flow events appear to have occurred with relatively high frequency between 1900 and 1904, between 1952 and 1958, between 1996 and 2006. No flow was recorded between December 2011 and October 2014.

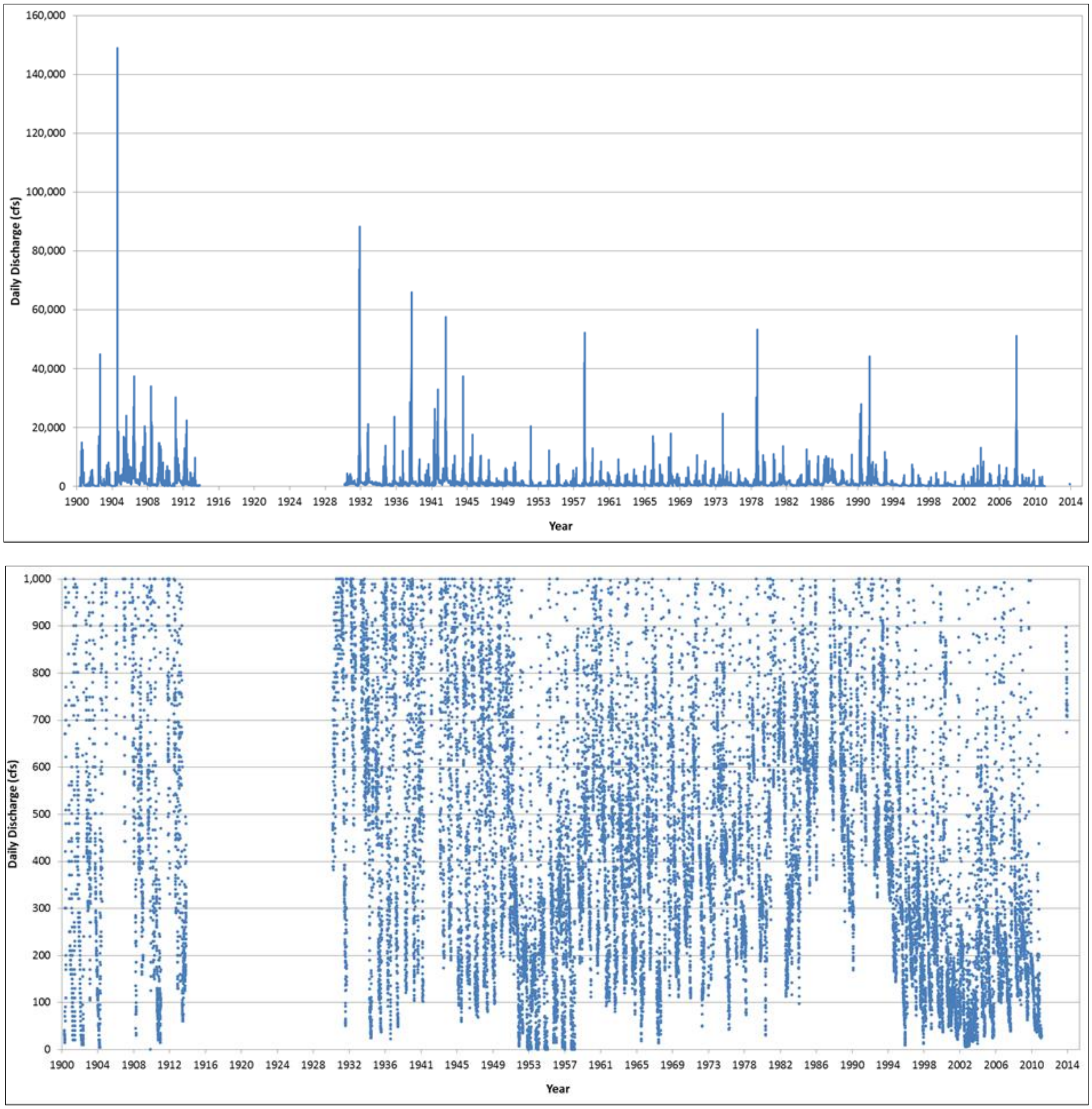

Figure 7-4. Streamflow below Rio Conchos Confluence 1900-2014

Source: IBWC (Filed a FOLA request on 3.7.19.

7.1.3 Spring Discharge Indicator

The San Solomon Spring System includes several springs that discharge to the Toyahville Basin near Toyahville, Texas. This group of springs includes: Phantom Lake, San Solomon, Giffin, Saragosa, West and East Sandia springs.

The only spring in this system that has a gaging station with a continuous period of record from the 1940s through today is Giffin Springs (Figure 7-5). The period of record extends back to 1930; however, measurements were sporadic prior to 1941. The average discharge for all measurements between 1941 and March 2019 is 4.2 cfs. The graph indicates that the longest period of below average flow within this period of record occurred between 1964 and 1981. Note that most of these years had between two and four discharge measurements recorded. Additionally, springflow has generally remained below average since May 2015.

Some of the springs within this system have ceased to flow. For example, Phantom Lake Springs in Jeff Davis County are the highest in elevation of all the springs in the San Solomon Spring System. This spring stopped flowing naturally in 2001. This is partially attributed to irrigation pumping in the local area.

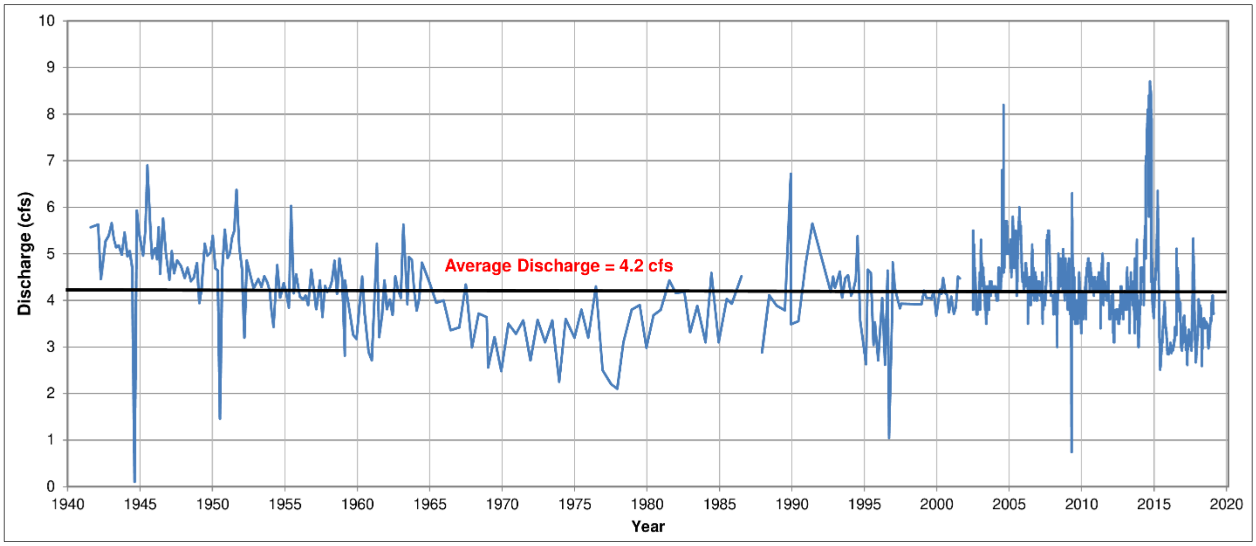

Figure 7-5. Giffin Springs Discharge 1941-March 2019

Source: Water Data for Texas

7.1.4 Groundwater Level Indicator

Figure 7-6 compares daily water level data from an existing real-time monitoring well with daily precipitation data from the nearby NWS Cooperative Weather Station at Panther Junction to illustrate aquifer response to precipitation events. This graph represents state well 73-47-404 which is completed within the Davis Mountains Igneous Aquifer in Brewster County. The data suggests that response time in the aquifer is quite rapid and occurs within a few days. Not all wells can be so readily correlated to rainfall events. Out of the nine pairs of wells and weather stations that were investigated within the Region, only this well showed an obvious response to rainfall occurring near the well.

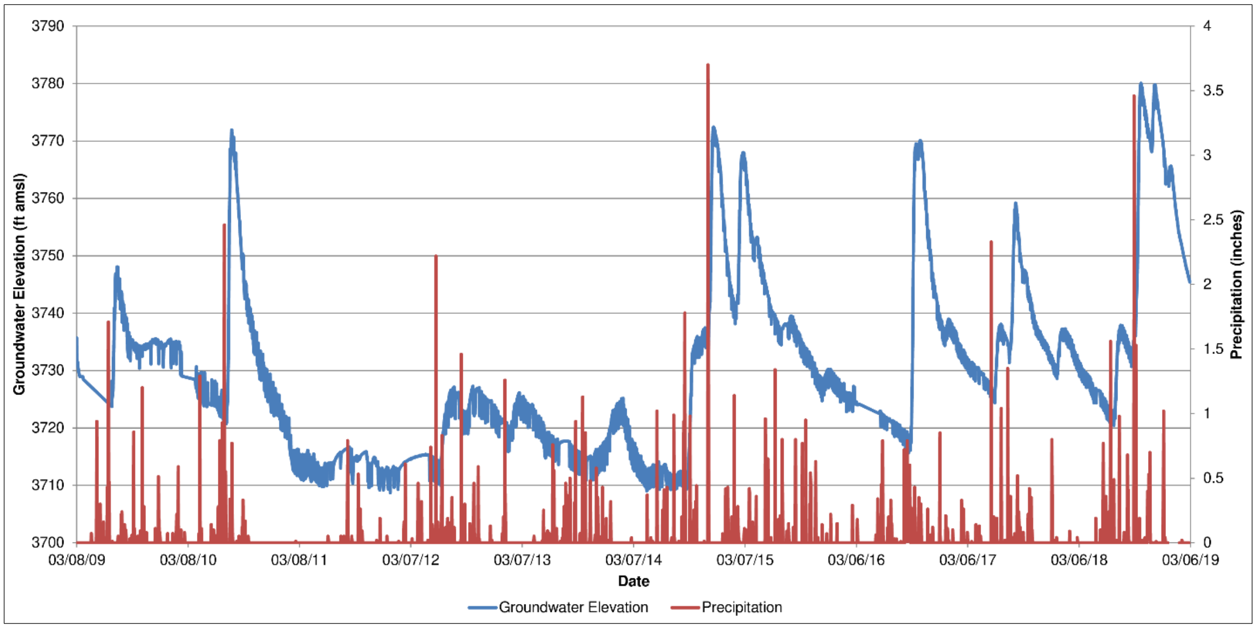

Figure 7-6. Daily Groundwater Elevation and Daily Precipitation, Igneous Aquifer, Brewster County

Source: Water Data for Texas

7.1.5 Far West Texas Drought of Record

The South-Central Climate Science Center prepared a report on the drought history for the Trans-Pecos of Texas in May of 2013. In this report, they determined that the period from February 1943 to November 1967 is the Drought of Record (DOR) for the Texas Trans-Pecos. The study points out that they consider the drought with the worst environmental conditions to outweigh the drought with the worst recorded impacts. They stated that a shorter less severe drought with high monetary losses (such as in 2011) does not outweigh a long and severe drought that occurred earlier in history. The study looked at data between 1895 and 2013. For this planning cycle, the drought of the 1950s is declared the DOR.

The catalyst for the recent drought can be attributed primarily to rainfall deficit (meteorological drought). The hydrological drought that has occurred because of rainfall deficit is evident in the decreased storage water levels of the Elephant Butte Reservoir, along with the decrease in the stream flow and spring discharge data that has been presented. However, the greatest unknown factor that these data collectively point to is the impact that can be attributed to anthropological factors.

The hydrological drought (impact on surface waters and groundwater) is a result of both meteorological and socioeconomic drought. To reiterate, socioeconomic drought occurs when demand exceeds supply due to a weather-related deficit. Typically, demand for a product increases with population growth and per capita consumptions. Supply increases due to efficiency technology and the construction of new water projects. If both are increasing, the rate of change between supply and demand is the key. However, when demand exceeds supply, vulnerability is magnified by water shortages during drought.

7.2 CURRENT DROUGHT PREPARATIONS AND RESPONSE

As mandated by 31 TAC 357.42(a)&(b), this section of the Plan summarizes and assesses all preparations and drought contingency plans that have been adopted by utilities and Groundwater Conservation Districts within the Far West Texas Region. The summary includes what specific triggers are used to determine the onset of each defined drought stage and the associated response actions that have been developed by local entities to decrease water demand during the drought stage.

Because of the range of conditions that affected the more than 4,000 water utilities throughout the State in 1997, the Texas Legislature directed the TCEQ to adopt rules establishing common drought plan requirements for water suppliers. Thus, TCEQ requires all wholesale public water providers, retail public water suppliers serving 3,300 connections or more, and irrigation districts to submit drought contingency plans (DCPs). In addition, many Groundwater Conservation Districts also have DCPs that provide education and voluntary action recommendations.

Plans are required to be made available for inspection upon request. Guidelines as to what should be included in each drought contingency plan can be found on TCEQ's website. at the following link: http://www.tceq.texas.gov/permitting/water_rights/contingency.html/#contents

DCPs are intended to establish criteria to identify when water supplies may be threatened and the actions that should be taken to ensure these potential threats are minimized. A common feature of drought contingency plans is a structure that allows increasingly stringent drought response measures to be implemented in successive stages as water supply decreases and water demand increases. This measured or gradual approach allows for timely and appropriate action as a water shortage develops. The onset and termination of each implementation stage should be defined by specific "triggering" criteria. Triggering criteria are intended to ensure that: 1) timely action is taken in response to a developing situation, and 2) the response is appropriate to the level of severity of the situation. Each water-supply entity is responsible for establishing its own DCP that includes appropriate triggering criteria and responses.

Figure 7-1 illustrates that drought conditions during this current planning period (2016-2020) were less severe than during the previous planning period (2011-2015). As a result, water utilities and conservation districts implemented less stringent measures during this recent period. Most entities declared no more than a low drought condition with voluntary restrictions throughout the warmer/dryer part of the year and escalating to moderate drought declarations during the dryer than normal summer months of 2018.

7.2.1 Drought Response Triggers

Drought response triggers should be specific to each water supplier and should be based on an assessment of the water user's vulnerability. In some cases, it may be more appropriate to establish triggers based on a supply source volumetric indicator such as a lake surface elevation or an aquifer static water level. Similarly, triggers might be based on supply levels remaining in an elevated or ground storage tank within the water distribution system; this is not a recommended approach, as the warning of supply depletion would be only three to four days. Triggers based on demand levels can also be effective, if the demands are very closely and frequently monitored. Whichever method is employed, trigger criteria should be defined on well-established relationships between the benchmark and historical experience. If historical observations have not been made, then common sense must prevail until such time that more specific data can be presented.

7.2.2 Surface Water Triggers

Surface water sources are among the first reliable indicators of the onset of hydrologic drought. The annual allotment of Rio Grande Project water is determined by the U.S. Bureau of Reclamation (USBR) based on the amount of usable water in storage in Elephant Butte and Caballo Reservoirs. Based on the amount of storage remaining in Elephant Butte and Caballo Reservoirs at the end of the primary irrigation season (early- to mid-October), the USBR determines the amount of water that will be delivered the following year. In general, a one-year drought in the Upper Rio Grande drainage basin will have little effect on overall storage in the reservoirs. However, a long-term drought would have a significant effect on water releases downstream. Downstream users, both irrigation and municipal, are thus aware in advance of coming surface water supply shortages and can react accordingly.

The City of El Paso's Drought and Emergency Management Plan (2012) is administered through EPW and is based on three Drought or Water Emergency Stages: (1) At Stage I El Paso County Water Improvement District No. 1 (EPCWID#1) declares surface water allotment is less than 0.5 acre-feet per acre on or before April 1st; or when water demand is projected to exceed available capacity as determined by El Paso Water; (2) A Stage II water emergency is triggered when the EPCWID#1 declares surface water allotment of less than 1.0 acre-feet per acre after April 1 but before May 1st or there is not enough continuous release of surface water; or water demand is projected by EPW to exceed available capacity; (3) A Stage III water emergency is triggered when the EPCWID#1 declares surface water allotment of less than 1.5 acre-feet per acre after May 1 but before May 15th or there is not enough continuous release of surface water; or water demand is projected by EPW to exceed available capacity. A water emergency may also be declared based on a water system failure due to weather, electrical or mechanical failure or contamination of source. Once any stage is declared, the General Manager of EPW can implement a variety of response measures designed to conserve water. These range from use restrictions to citations for noncompliance.

Most of the other communities in El Paso County receive their water supplies from EPW or from other water-supply entities including the Horizon Regional MUD, El Paso County WCID No.4, and the Lower Valley Water District. Because of their reliance on supply provided by EPW, the Lower Valley Water District drought contingency triggers and responses are similar to the triggers and responses developed by EPW. The other wholesale water providers rely on groundwater, which is discussed under the following Groundwater Triggers section.

Irrigation districts depend on runoff from watersheds in the Upper Rio Grande drainage basins of New Mexico and southern Colorado to provide surface water to support irrigation in El Paso and Hudspeth Counties. Hence, drought triggers for the EPCWID #1 and the Hudspeth County Conservation and Reclamation District No.1 (HCCRD #1) are established based on storage levels in Elephant Butte and Caballo Reservoirs, which are in turn dependent on meteorological and hydrological conditions in these watersheds.

Drought conditions, which impact the EPCWID #1, are those that affect the headwaters of the Rio Grande and its tributaries, such that Rio Grande Compact water deliveries into Elephant Butte Reservoir are reduced. The district's board of directors determines when a drought exists and establishes the yearly delivery allotment to its water users based on its diversion allocation from the USBR. Generally, when water storage in Elephant Butte Reservoir is less than 0.9 million acre-feet during the irrigation season (March through September), the USBR declares drought conditions and sets its diversion allocations (using the D1 and D2 curves) to the irrigation districts based on a delivery allotment of less than its normal (non-drought) three acre-feet per acre. During times of drought, the district will lower its delivery allotment based on the amount of its reduced diversion allocation from the USBR and its delivery commitments to its users. The extent of the reductions in the water allotments will be dependent on the severity of the drought conditions and will remain in effect until the conditions that triggered the drought contingency no longer exist.

The HCCRD #1 bases drought contingency planning on evaluation of the water supply projected and received by the EPCWID #1, since all waters received by HCCRD #1 are return flows and operational spills for El Paso County. Since conditions, to a degree, can be predicted prior to a crop season, the drought mitigation plan largely affects agricultural producers cropping plan. When a mild or moderate predicted shortage occurs, the HCCRD #1 will notify its clientele of the amount of the expected shortage. For a severe shortage, where the water supply will provide less than 50 percent of the expected demand, agricultural producers will be asked to prioritize their water requests based upon crop needs.

Water in the Lower Rio Grande segment is used principally for irrigation, recreation, and environmental needs. A drought trigger for this segment of the river is based on flows of less than 35,438 acre-feet. The TCEQ Rio Grande Watermaster administers the allocation of Texas' share of the international water and is responsible for informing water-rights users of expected diversions during drought years.

7.2.3 Groundwater Triggers

Groundwater triggers that indicate the onset of drought in Far West Texas are not as easily identifiable as relative to surface-water triggers. This is attributable to (1) the rapid response of stream discharge and reservoir storage to short-term changes in climatic conditions within a region and within adjoining areas where surface drainage originates, and (2) the typically slower response of groundwater systems to recharge processes. Although climatic conditions over a period of one or two years might have a significant impact on the availability of surface water, aquifers of the same area might not show comparable levels of response for much longer periods of time, depending on the location and size of recharge areas in a basin, the distribution of precipitation over recharge areas, the amount of recharge, and the extent to which aquifers are developed and exploited by major users of groundwater.

Several groundwater basins are identified in Chapter 3 as aquifers that will likely not experience consistent water-level decline, or mining, based on comparisons between projected demand, recharge and storage. In these areas, water levels might be expected to remain constant or relatively constant over the 2020 to 2070 planning period. Because of minimal water-level changes in these aquifers, water levels are not recommended as a drought-condition trigger. Atmospheric conditions are a better indicator for these areas.

Basins that do not receive sufficient recharge to offset natural discharge and pumpage may be depleted of groundwater (e.g., mined). The rate and extent of groundwater mining are related to the timeframe and the extent to which withdrawals exceed recharge. In such basins, water levels may fall over long periods of time, eventually reaching a point at which the cost of lifting water to the surface becomes uneconomic. Thus, water levels in such areas may not be a satisfactory drought trigger. Instead, communities might consider the rate at which water levels decline in response to increased demand during drought as a sufficient indicator.

Water levels in observation wells in and adjacent to municipal wellfields, especially where wells are completed in aquifers that respond relatively quickly to recharge events, may be established as drought triggers for municipal utilities in the future providing a sufficient number of measurements are made annually to establish a historical record. Water levels below specified elevations for a pre-determined period of time might be interpreted to be reasonable groundwater indicators of drought conditions. Until such historical water-level trends are established, municipal utilities will likely continue to depend on demand as a percentage of production capacity as their primary drought trigger. Twelve water-supply entities were listed in Table 6-1 in the 2011 Plan. Drought triggers of all entities are structured around system production capacity and daily demand, except for El Paso, which is structured upon surface-water allotment stages. None of the entities used groundwater triggers. However, while most of the entities rely on a system capacity trigger of some kind, they also have groundwater wells that they pump from and monitor.

7.2.4 System Capacity Triggers

Because of the above described problems with using water levels as drought-condition indicators, several municipal water-supply entities in the Far West Texas Region that rely on groundwater generally establish drought-condition triggers based on levels of demand that exceed a percentage of the systems production capacity. Alpine, Van Horn (and Sierra Blanca) Anthony, Vinton, Horizon Regional MUD (Horizon City), Dell City, Fort Davis WSC (Fort Davis), Marfa, Presidio and Terrell County WCID #1 (Sanderson) have adopted system capacity triggers. Several entities have drought responses triggered when daily water demand exceeds 75 percent of production capacity.

El Paso (EPW) receives surface water allocations from the local irrigation district, El Paso County Water Improvement District No.1 (EPCWID#1) via the Rio Grande Project. Currently, El Paso has water rights to about 65,000 ac-ft/yr. EPW initiates the various drought triggers based on the amount of surface water being provided by the EPCWID #1 as described in Section 7.3.2 above.

7.2.5 Municipal and Wholesale Water Provider Drought Contingency Plans

The TCEQ requires all retail public water suppliers serving 3,300 connections or more and wholesale public water providers to submit a drought contingency plan as a way to prepare and respond to water shortages. The amended Title 30, Texas Administrative Code, Chapter 288 became effective on December 6, 2012 addressing TCEQ's guidelines and plan requirements. The forms for wholesale public water providers, retail public water suppliers and irrigation districts are available at:

https://www.tceq.texas.gov/permitting/water_rights/wr_technical-resources/contingency.html#whattoinclude Drought contingency plans for municipal uses by public water suppliers must document coordination with the regional water planning groups to ensure consistency with the regional water plans. The following entities have prepared drought contingency plans which are accessible at the specified websites:

- City of Alpine (http://cityofalpine.com/)
- City of Van Horn (http://vanhornutilities.com)
- Town of Anthony (http://townofanthony.org/index.php)
- City of El Paso (https://www.epwater.org/)

- El Paso County Tornillo WID
- El Paso County WCID #4 (Fabens)
- Fort Bliss
- Horizon Regional MUD (http://horizonregional.com/)
- Lower Valley Water District (http://www.lvwd.org/)
- City of Clint (drought plan same as LVWD)
- City of San Elizario (drought plan same as LVWD)
- City of Socorro (drought plan same as LVWD)
- City of Vinton (drought plan same as EPW)
- Fort Davis WSC
- City of Marfa
- City of Presidio (http://presidiotx.us/)
- Terrell County WCID #1

A list of entities, their supply source, specific triggers and actions, for each drought stage is provided in Table 7-1.

Table 7-1. Municipal Mandated Drought Triggers and Actions

Water Supply Entity	Water Supply Source	Drought Trigger	Drought Stage and Response				
			Mild	**Moderate**	**Severe**	**Critical**	**Emergency**
City of Alpine	Igneous (Meriwether #1 & #2 wells)	Demand-based triggers include the following components: 1) percent of water treatment capacity, 2) total daily demand as percent of pumping capacity, 3) storage capacity and 4) well pump run time.	Demand reaches 90% of production capacity; system failure that would limit the capacity of the system below 85% during peak demand periods.	Demand reaches 95% of production capacity; system failure that would limit the capacity of the system below 75% during peak demand periods.	Demand reaches 100% of production capacity; system failure that would limit the capacity of the system below 70% during peak demand periods.	Extended period of severe condition or any natural catastrophic situation.	N/A
			Voluntary- reduce water demand.	Mandatory- lawn watering schedule.	Set limits on water consumption; prohibit use of specific outdoor watering activities.	N/A	N/A
City of El Paso (EPW)	Hueco-Mesilla Bolson, Rio Grande River	Surface water allotment from El Paso County WID #1; system capacity limits.	EPCWID decreases allotment less than 0.5 acre-foot per acre on or before April 1; water demand is projected to exceed EPWU system capacity.	EPCWID decreases allotment less than 1.0 acre-foot per acre on or after April 1 but before May 1 or there is not a continuous release of surface water; water demand is projected to exceed EPWU system capacity.	EPCWID decreases allotment less than 1.5 acre-foot per acre after May 1 but before May 15 or there is not a continuous release of surface water; water demand is projected to exceed EPWU system capacity.	N/A	N/A
			Voluntary- reduce water demand by 25%.	Mandatory- lawn watering schedule.	Set limits on water consumption; prohibit use of specific outdoor watering activities.	N/A	N/A
City of Marfa	Igneous	Base on water supply and/or demand conditions.	Demand exceeds 90% of production capacity for 3 consecutive days; system disruption occurs that limits the capacity of the system below 85% during peak demand periods.	Demand exceeds 95% of production capacity for 3 consecutive days; system disruption occurs that limits the capacity of the system below 75% during peak demand periods.	Demand exceeds 98% of production capacity for 3 consecutive days; system disruption occurs that limits the capacity of the system below 70% during peak demand periods.	Extended period of severe condition or any natural catastrophic situation.	N/A
			Voluntary- reduce water demand by 1-5%.	Reduce water demand by 5-10%.	Reduce water demand by10-15%.	Reduce water demand by15-20%.	Reduce water usage as deemed necessary.

Table 7-1. (Continued) Municipal Mandated Drought Triggers and Actions

Water Supply Entity	Water Supply Source	Drought Trigger	Drought Stage and Response				
			Mild	Moderate	Severe	Critical	Emergency
City of Presidio	West Texas Bolson	Base on system capacity limits.	Total daily water demand equals or exceeds 2 million gallons on a single day.	Total daily water demand equals or exceeds 2 million gallons for 3 consecutive days.	Total daily water demand equals or exceeds 2 million gallons for 7 consecutive days.	Total daily water demand equals or exceeds 2 million gallons for 14 consecutive days.	Major system failures or supply contamination.
			Voluntary- reduce water use below 2 million gallons per day.	Mandatory- reduce water use below 2 million gallons per day.	Mandatory- reduce water use below 2 million gallons per day by restricting non-essential water use.	Mandatory- reduce water use below 2 million gallons per day by restricting irrigation of landscaped areas.	Mandatory- reduce water use below 2 million gallons per day by allocating water according to the water allocation plan.
City of Van Horn	West Texas Bolson	Demand exceeds production or storage capability measured over a 24-hr. period and refilling the storage facilities is rendered impossible.	Triggers were not provided in the DCP	Triggers were not provided in the DCP	Triggers were not provided in the DCP	Demand exceeds 80% of production capacity.	Demand exceeds 90% of production capacity.
			Voluntary- reduce water use.	Limit water usage determined by the plant's capability to provide continuous service in direct proportion to the loss of production/refill capability of the storage facility.	All outdoor water usage is prohibited.	Allocate water.	All uses of public water supply will be banned except in cases of emergency.
El Paso County Tornillo WID	Hueco-Mesilla Bolson	Base on system capacity limits and known water levels in the groundwater well(s).	N/A	Treated water reservoir levels do not fill above 70% overnight.	Treated water reservoir levels do not fill above 50% overnight and/or static water level in the EPCTWID well is less than previous month.	EPCTWID well capacity is equal to or less than 80% of the well's original specific capacity.	Major system failures or supply contamination.
			Voluntary- reduce water demand by 3%.	Reduce water demand by 10%.	Reduce water demand by 30%.	Reduce water demand by 40%.	Reduce water demand by 50%.

Table 7-1. (Continued) Municipal Mandated Drought Triggers and Actions

Water Supply Entity	Water Supply Source	Drought Trigger	Drought Stage and Response				
			Mild	Moderate	Severe	Critical	Emergency
El Paso County WCID #4	Hueco-Mesilla Bolson	Base on system capacity limits.	Average daily water use reaches 80% for 3 consecutive days.	Average daily water use reaches 90% for 3 consecutive days.	Average daily water use reaches 100% for 3 consecutive days.	Failure of system components is reduced to only one well.	Major system failures or supply contamination.
			Voluntary- reduce water demand by 15%.	Reduce water demand by 25%.	Reduce water demand by 50%.	Reduce water demand by 75%.	Reduce water demand by 75%.
Fort Bliss	Hueco-Mesilla Bolson	Base on system capacity limits.	N/A	Demand exceeds 90% of production capacity for 2 consecutive days.	Demand exceeds 95% of production capacity for 2 consecutive days.	Demand exceeds 100% of production capacity for 2 consecutive days.	Major system failures or supply contamination.
			N/A	Reduce water demand by 20%.	Reduce water demand by 30%.	Reduce water demand by 40%.	Reduce water demand by 50%.
Fort Davis WSC	Igneous	Base on system capacity limits.	N/A	Total daily water demand ranges from 60-70% of production capacity.	Total daily water demand exceeds 75% of production capacity.	Total daily water demand exceeds 75% of production capacity for more than 5 consecutive days.	Major system failures or supply contamination.
			Voluntary- reduce water demand by 10%.	Mandatory- reduce water demand by 10%.	Reduce water usage to a point the District can revert to the previous stage and continue to reduce usage until 10% reduction is secured.	Discontinue all non-essential and landscape irrigation water use.	Water rationing may be put into effect.
Horizon Regional MUD	Hueco-Mesilla Bolson	Base on system capacity limits and water levels in District's well(s).	Total daily water demands reach 80% of the District's capacity for 5 consecutive days.	Total daily water demands reach 90% of the District's capacity for 5 consecutive days.	Demand equals or exceeds 95% of the District's capacity for 3 consecutive days.	Demand meets 100% of capacity for 3 consecutive days.	Major system failures or supply contamination.
			Voluntary- reduce water demand by 10%.	Mandatory- reduce water demand by 10%.	Reduce water usage to a point the District can revert to the previous stage and continue to reduce usage until 10% reduction is secured.	Discontinue all non-essential and landscape irrigation water use.	Water rationing may be put into effect.

Table 7-1. (Continued) Municipal Mandated Drought Triggers and Actions

Water Supply Entity	Water Supply Source	Drought Trigger	Drought Stage and Response				
			Mild	Moderate	Severe	Critical	Emergency
Lower Valley Water District	Hueco-Mesilla Bolson	Water levels in Elephant Butte Reservoir are less than a designated depth; decrease in surface water allotment; and increase in demand.	Water stored in Elephant Butte Reservoir is less than 50,000 acre-feet; surface water allotment is less than or equal to 3.0 acre-ft./acre; or demand exceeds 90% system capacity.	Surface water allotment less than or equal to 2.5 acre-ft./acre; or demand exceeds 95% system capacity.	Surface water allotment less than or equal to 2.0 acre-ft./acre; or demand exceeds 100% system capacity.	N/A	Major system failures or supply contamination.
			Voluntary- reduce landscape irrigation water use by 50%.	Voluntary- reduce industry water consumption by 25%	All non-essential water use is prohibited.	N/A	Water rationing may be put into effect.
Terrell County WCID #1 (Sanderson)	Edwards-Trinity (Plateau)	Base on system capacity limits.	Daily water demand reaches or exceeds 80% of the system's capacity for 5 consecutive days.	Daily water demand reaches or exceeds 90% of the system's capacity for 5 consecutive days.	Daily water demand reaches or exceeds 100% of the system's capacity for 2 consecutive days.	N/A	N/A
			Inform the public.	All non-essential water use is prohibited.	Prohibit outside water use.	N/A	N/A
Town of Anthony	Hueco-Mesilla Bolson	Base on system capacity limits.	Daily water demand exceeds 90% of the system's capacity for 3 consecutive days; equipment or system failure occurs that limits the capacity of the system below 85% during high demand periods.	Daily water demand exceeds 90% of the system's capacity for 3 consecutive days; equipment or system failure occurs that limits the capacity of the system below 75% during high demand periods.	Daily water demand exceeds 98% of the system's capacity for 3 consecutive days; equipment or system failure occurs that limits the capacity of the system below 70% during high demand periods.	N/A	Major system failures or supply contamination.
			Voluntary- reduce water demand by 1-5%	Reduce water demand by 5-10%	Reduce water demand by 10-15%	N/A	Water rationing may be put into effect.

7.2.6 Groundwater Conservation District Drought Management

A discussion of the creation and the goals of the six Groundwater Conservation Districts (GCDs) formed in Far West Texas are discussed in more detail in Chapter 5 - Section 5.3. This section will focus on summarizing drought management by the Districts.

Six districts are currently in operation within the planning region:

- Brewster County GCD (http://westtexasgroundwater.com)
- Culberson County GCD (http://www.co.culberson.tx.us/page/culberson.GroundWaterConservationDistrict)
- Hudspeth County UWCD #1
- Jeff Davis County UWCD
- Presidio County UWCD
- Terrell County GCD

Groundwater Conservation Districts are required to define management goals that specifically address drought conditions within their groundwater management plans. These are delineated via management objectives and performance standards.

7.2.6.1 Brewster County Groundwater Conservation District

Management Objective – file and discuss at each meeting of the Board, drought emergency contingency plans received since the previous meeting.

The District, in partnership with the landowners of the District, hopes to monitor changing storage conditions of groundwater due to drought conditions.

7.2.6.2 Culberson County Groundwater Conservation District

Management Objective – The District will monitor the PDSI and the TWDB drought page and report findings and actions to the District Board on a quarterly basis. If PDSI indicates that the District will experience severe drought conditions, the District will notify all public water suppliers within the District.

7.2.6.3 Hudspeth County Underground Water Conservation District No. 1

Management Objective – the annual amount of groundwater permitted by the District for withdrawal from the portion of the Bone Spring-Victorio Peak aquifer located within the District may be curtailed during periods of extreme drought in the recharge zone of the aquifer or because of other conditions that cause significant declines in groundwater levels. Such curtailment may be triggered by the District's Board based on the groundwater levels measured in the District's monitoring well(s).

7.2.6.4 Jeff Davis County Underground Water Conservation District

Management Objective – the District will monitor the PDSI and report to the Board, the number of times the District experiences PDSI of less than one (mild drought). If PDSI indicates that the District will experience severe drought conditions, the District will notify all public water suppliers within the District.

7.2.6.5 Presidio County Underground Water District

Management Objective – the District will monitor the PDSI at least once quarterly. If PDSI indicates that the District will experience severe drought conditions, the District will notify all public water suppliers within the District.

7.2.6.6 Terrell County Groundwater Conservation District

Management Objective – the District will access the PDSI map and will check for updates to the Drought Preparedness Council Situation Report and discuss current drought conditions during at least one Board meeting a year.

7.3 EXISTING AND POTENTIAL EMERGENCY INTERCONNECTS

According to Texas Statute §357.42(d)(e) regional water planning groups are to collect information on existing major water infrastructure facilities that may be used in the event of an emergency shortage of water. Pertinent information includes identifying the potential user(s) of an interconnected facility, the potential supplier(s), the estimated potential volume of supply that could be provided, and a general description of the facility. Texas Water Code §16.053(c) requires more specific information regarding facility locations to remain confidential. This section provides general information regarding existing and potential emergency interconnects among water user groups within Far West Texas.

El Paso Water provides water to several entities (see Chapter 2 Table 2-3) and has the connection to supply additional emergency supplies if needed. Additional water supply is also available to EPW during an emergency shortage of water via the Desalination Plant and from EPCWID#1 if supply from the Rio Grande is available. Major water infrastructure facilities with the potential to interconnect with other utilities were identified through a survey process to better evaluate existing and potentially feasible emergency interconnects. Six potential interconnects are identified as shown in Table 7-2.

Table 7-2. Existing and Potential Emergency Interconnects to Major Water Facilities

Entity Providing Supply	Entity Receiving Supply
Lower Valley Water District	El Paso WCID #4 Fabens
	El Paso Co. Tornillo WID
	Horizon Regional MUD
	Clint
EPW	Town of Anthony
	LVWD
	Fort Bliss
	Vinton
	Paseo Del Este MUD#1
	East Montana
	Hacienda Del Norte
Fort Davis Estates	Fort Davis
EPCWID#1	EPW

7.4 EMERGENCY RESPONSES TO LOCAL DROUGHT CONDITIONS OR LOSS OF MUNICIPAL SUPPLY

Texas Statute §357.42(g) requires regional water planning groups to evaluate potential temporary emergency water supplies for all County-Other WUGs and municipalities with 2010 populations less than 7,500 that rely on a sole source of water. The purpose of this evaluation is to identify potential alternative water sources that may be considered for temporary emergency use if the existing water supply sources become temporarily unavailable due to extreme hydrologic conditions such as emergency water right curtailment, unanticipated loss of reservoir conservation storage, or other localized drought impacts.

This section provides potential solutions that should act as a guide for municipal water users that are most vulnerable in the event of a loss of supply. Entities evaluated for emergency responses to local drought conditions or loss of municipal supply were assumed to have 180 days or less of remaining supply. This review was limited and did not require technical analyses or evaluations following in accordance with 31 TAC §357.34.

There are 12 municipal and County-Other entities in the Region that have a 2010 Census population of less than 7,500 and rely upon a sole source of water. Eleven entities rely on groundwater and one (City of Clint) relies on water purchased from another entity. Potential emergency water supply sources that might be used by these small sole-source municipal or County-Other entities include the following:

- New local groundwater well
- Emergency interconnect
- Use of other named local supply
- Trucked-in water delivery
- Brackish groundwater limited treatment
- Brackish groundwater desalination
- Release from upstream reservoir
- Curtailment of upstream and/or downstream water rights

Based upon personal communication with the entities, the addition of a new local groundwater well along with trucking in water was identified by all entities as a potential emergency water supply source. The City of Clint and the City of Presidio would also consider the curtailment of proximal water rights as a feasible option under emergency conditions. The entities along with feasible potential emergency water supply options have been included in Table 7-3.

Table 7-3. Emergency Responses to Local Drought Conditions

Entity				Implementation Requirements									
Water User Group Name	**County**	**2020 Population**	**2020 Demand**	**Curtailment of upstream/downstream**	**Additional groundwater well**	**Brackish groundwater limited treatment**	**Brackish groundwater desalination**	**Emergency interconnect**	**Trucked - in water**	**Type of infrastructure required**	**Entity providing supply**	**Other local entities required to participate**	**Emergency agreements already in place**
Alpine	Brewster	6,066	1,934		▪				▪				
Anthony	Brewster	4,206	770		▪			▪	▪	Pipeline/Truck	EPW		General
Clint	El Paso	1,131	92	▪	▪			▪	▪	Pipeline/Truck	LVWD	LVWD	
East Montana Water System	El Paso	6,599	806		▪				▪				
El Paso Co. Tornillo WID	El Paso	3,202	320		▪			▪	▪		LVWD		
El Paso WCID 4 Fabens	El Paso	8,858	810		▪			▪	▪		LVWD		
Esperanza Water Service	Hudspeth	905	142		▪				▪				
Federal Correctional Institution - La Tuna	El Paso	1,668	352		▪				▪				
Fort Davis Estates	Jeff Davis	1,361	319		▪			▪	▪	Pipeline/Truck	Fort Davis WSC		
Haciendas Del Norte WID	El Paso	1,218	196		▪				▪				
Hudspeth County WCID 1	Hudspeth	952	142		▪				▪				
Lajitas Municipal Services	Brewster	542	103		▪				▪				
Marathon WSSS	Brewster	444	124		▪				▪				
Marfa	Presidio	2,583	690		▪				▪				
Paseo Del Este MUD 1	El Paso	8,116	1,054		▪				▪				
Presidio	Presidio	5,458	738	▪	▪				▪	Trucks			
Terrell County WCID 1 (Sanderson)	Terrell	870	178		▪				▪	Trucks			
Sierra Blanca (County-Other)	Hudspeth	553	58		▪		▪	▪	▪	Trucks		Hudspeth Co.WCID1	General
Van Horn	Culberson	2,319	662		▪				▪	Trucks			
Valentine (County-Other)	Jeff Davis	198	168		▪				▪				

In order to qualify for emergency funds that are earmarked for emergency groundwater supply wells, entities must have a drought plan in place and be currently listed as an entity that is limiting water use to avoid shortages. This list is updated weekly by the TCEQ's Drinking Water Technical Review and Oversight Team and can be found at: https://www.tceq.texas.gov/drinkingwater/trot/droughtw.html.

There is some assistance available through the Texas Department of Agriculture and the Texas Water Development Board. There are requirements, deadlines, and a specific application process. Contact the TWDB by e-mail, <Financial_Assistance@twdb.texas.gov>, or call 512-463-0991. Contact the Texas Department of Agriculture, Community Development Block Grants, or call 512-463-7476. Funding is limited.

Other TCEQ Guidance resources:

- Emergency and Temporary Use of Wells for Public Water Supplies (RG-485)
- https://www.tceq.texas.gov/assets/public/comm_exec/pubs/rg/rg-485.pdf Video: Workshop on Drought Emergency Planning for Public Water Systems in Texas http://www.youtube.com/watch?v=BdlF9CEcGPI&feature=plcp&context=C34378a7UDOEgsToPDskJNYWXf5I3pKq8tW9pkVqQU

7.5 REGION-SPECIFIC MODEL DROUGHT RESPONSE RECOMMENDATIONS AND MODEL CONTINGENCY PLANS

As mandated by TAC 357.42(c)&(i), the RWPGs shall develop drought response recommendations regarding the management of existing groundwater and surface water sources in the RWPA designated in accordance with §357.32. The RWPGs shall make drought preparation and response recommendations regarding the development of, content contained within, and implementation of local drought contingency plans. The RWPGs shall develop region-specific model drought contingency plans that shall be presented in the RWP which shall be consistent with 30 TAC Chapter 288 requirements.

A new component of the planning process introduced in this planning cycle is Regional Drought Planning, which essentially expands the conceptualization and application of drought planning by specific entities to encompass the entire Far West Texas Region. The approach utilized in developing a region-specific drought plan considers the following: 1) all regional groundwater and surface water sources, 2) current drought plans that are being utilized by user entities within the region, and 3) current monitoring stations within the region that have evolved since the previous planning cycle.

The goals of this approach are: 1) to gain a comprehensive view of what particular resources are being monitored by entities within the region, 2) determine which resources are not being monitored, 3) determine which users do not fall under the umbrella of existing DCPs, 3) identify potential monitoring stations with publicly accessible real-time data that currently exist, 4) determine how these data can be utilized for the water user groups that do are not subject to existing DCPs, and ultimately 5) development of a regional model drought contingency plan.

As discussed in Section 7.2, numerous groundwater conservation districts, irrigation districts, municipalities, and various public supply systems have written drought management plans or drought contingency plans and have provided them for inclusion in the Regional Plan.

7.5.1 Regional Groundwater Resources and Monitoring

Nine groundwater sources identified within Far West Texas and their contribution to total regional groundwater supply, based upon historical pumping averages for years 2012 through 2016, are:

- Bone Spring-Victorio (15%)
- Capitan Reef Complex (3%)
- Edwards-Trinity (Plateau) (less than 1%)
- Hueco-Mesilla (39%)
- Igneous (2%)
- Marathon (less than 1%)
- Rustler (less than 1%)
- West Texas Bolson (11%)
- Other (29%)

Current drought contingency plans are detailed in Section 7.3.5 and Table 7-1. State well numbers of the monitoring wells used by municipal entities that utilize groundwater triggers are shown in Table 7-4. A map of these locations is included as Figure 7-7.

Table 7-4. Current Municipal Trigger Monitoring Wells

Water Supply Entity	County	Water Supply Source	Well ID
City of Marfa	Presidio	Igneous	51-48-603
City of Marfa	Presidio	Igneous	51-48-602
Terrell County WCID #1	Terrell	Edwards-Trinity (Plateau)	53-53-804
Terrell County WCID #1	Terrell	Edwards-Trinity (Plateau)	53-53-806
Terrell County WCID #1	Terrell	Edwards-Trinity (Plateau)	53-53-809
Terrell County WCID #1	Terrell	Edwards-Trinity (Plateau)	53-53-903

The previous Far West Texas Water Plans identified wells that could potentially be used for drought monitoring. Table 7-5 provides a selection of groundwater trigger wells included in the 2016 Plan, with an updated status and history of measurements.

Table 7-5. 2016 RWP Groundwater Trigger Monitoring Wells

Aquifer	County	Well ID	Monitoring Agency	Period of Record & Measurement Count	Current Status
Igneous	Brewster	52-35-709 (Cartwright Well)	TWDB	1958-2019 (100 measurements)	Active
Marathon	Brewster	52-55-106	Registered Driller	2008 (1 measurement)	Inactive
Lobo	Culberson	51-02-903	TWDB	1950-2019 (66 measurements)	Active
Wild Horse	Culberson	47-59-106	TWDB	1953-2019 (64 measurements)	Active
Hueco Bolson	El Paso	49-13-710 (EPWU #67)	City	1968-2009 (50 measurements)	Inactive (plugged in 2009)
Mesilla Bolson	El Paso	49-04-138 (JL-EPWU #117)	USGS	1952-2010 (46 measurements)	Monitoring discontinued in 2010
Rio Grande Alluvium	El Paso	49-04-701	U.S. Bureau of Reclamation	1946-1990 (532 measurements)	Unknown
Bone Spring-Victorio	Hudspeth	48-07-516	TWDB	1966-2019 Recorder well	Active
Ryan Flat	Jeff Davis	51-19-902 (2 Section Well)	TWDB	1955-2019 (61 measurements)	Active
Edwards-Trinity (Plateau)	Terrell	53-53-601	Terrell County WCID #1	1986 (no measurements)	Unknown

The TWDB maintains a component of their website called Water Data for Texas that is a collective of real-time monitoring data from both groundwater wells and reservoir stage-capacity gages. Table 7-6 is a summary of the 7 groundwater wells located within Far West Texas, with their locations included on Figure 7-7.

Table 7-6. Currently Active (Real-Time) Monitoring Wells

Source: Water Data for Texas

County	State Well Number	Aquifer	Aquifer Type	Entity/Cooperator	Data Transmission	Start Date - Period of Record
Brewster	7347404	Other	Unconfined	Texas Water Development Board	Satellite	5/9/2007
Culberson	4759123	Salt Bolson and Cretaceous	Unconfined	Texas Water Development Board	Satellite	6/10/1996
El Paso	4904476	Hueco-Mesilla Bolson	Unconfined	U.S. Geological Survey	Satellite	10/15/2013
El Paso	4913301	Hueco-Mesilla Bolson	Unconfined	Texas Water Development Board	Satellite	12/5/2002
Hudspeth	4807516	Bone Spring-Victorio Peak	Unconfined	Texas Water Development Board	Satellite	3/10/1966
Jeff Davis	5225209	Igneous	Unconfined	Texas Water Development Board	Satellite	9/5/2001
Presidio	5129805	West Texas Bolson	Unconfined	Texas Water Development Board	Satellite	9/15/1993

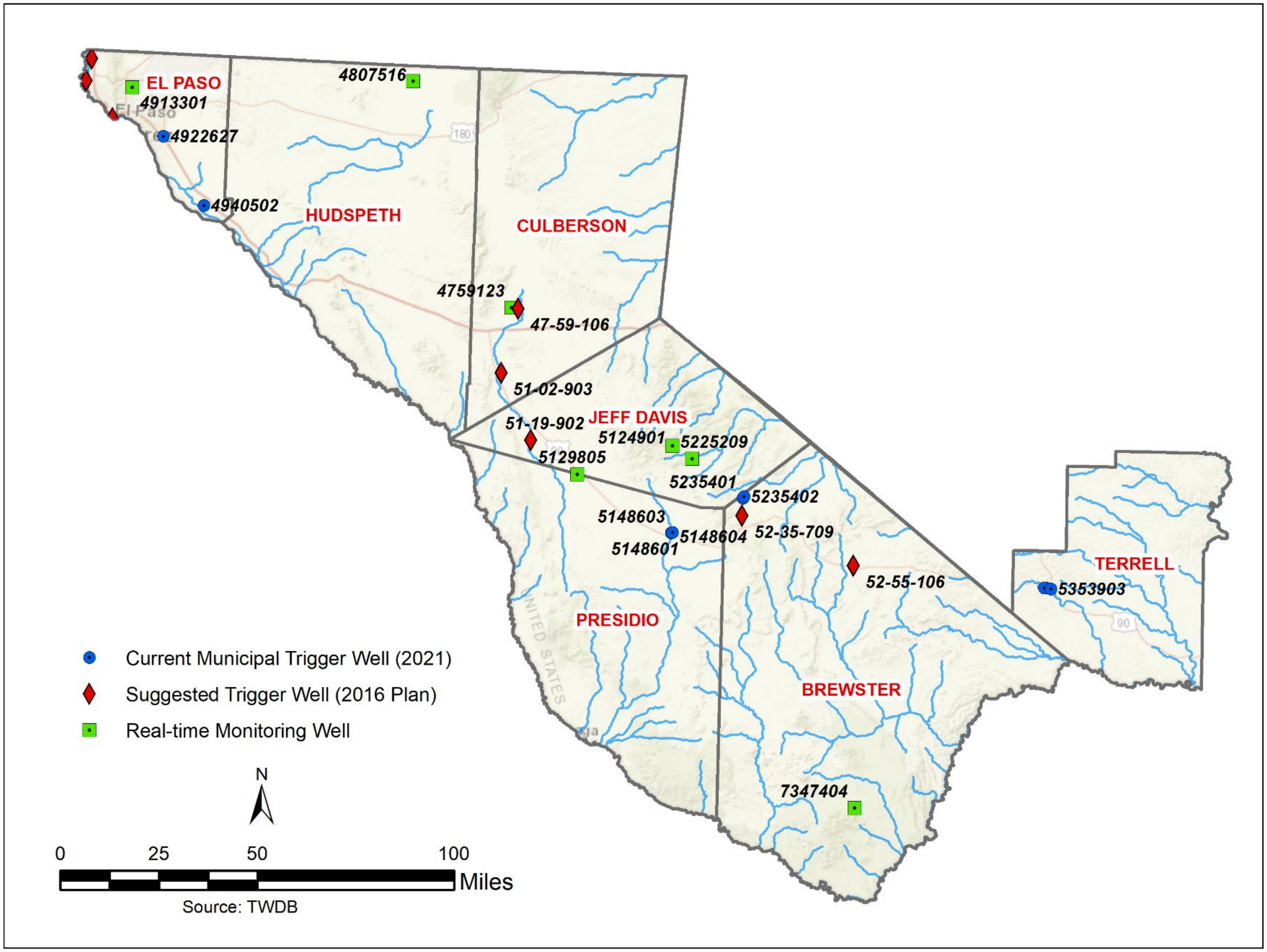

Figure 7-7. Regional Monitoring and Trigger Wells

7.5.2 Regional Surface Water Resources

Surface water sources identified within Far West Texas and their contribution to total regional surface water supply are:

- Rio Grande (65%)
- Rio Grande Return Flows (34%)
- Pecos River (<1%)

The basin contribution to the regional supply calculation is based upon the WAM Run 3 (Full Authorization) availability numbers.

A list of selected currently active stream flow and spring flow and gauging stations are listed in Table 7-7 International Boundary Water Commission (IBWC) and U.S. Geological Survey (USGS) gauging stations located along the Rio Grande between the Rio Conchos and the Pecos River are presented on Figure 7-8. There are five stations that are currently operating in this reach of the Rio Grande. The IBWC and USGS stations have real-time data that is publicly accessible online.

Table 7-7. Currently Active Surface Water Gauging Locations, USGS, IBWC

County	Station ID	Station Name	Agency	Period of Record	Measurement Frequency
Presidio	08-3650.00	Rio Grande below American Dam at El Paso, Texas	IBWC	1938-2019	15 minutes
Presidio	08-3705.00	Rio Grande at Old Fort Quitman, Texas	IBWC	1923-2019	15 minutes
Presidio	08-3712.00	Rio Grande near Candelaria, Texas	IBWC	1976-2019	15 minutes
Presidio	08-3715.00	Rio Grande above Rio Conchos near Presidio, Texas	IBWC	1900-2019	15 minutes
Presidio	08-3742.00	Rio Grande below Rio Conchos near Presidio, Texas	IBWC	1900-2019	15 minutes
Presidio	08-3743.00	Rio Grande below Mulato Dam near Redford, Texas	IBWC	2014-2019	15 minutes
Val Verde	08-4474.10	Pecos River near Langtry, Texas	IBWC	1967-2019	15 minutes
Brewster	08-3745.00	Terlingua Creek near Terlingua, Texas	IBWC	1932-2019	15 minutes
Brewster	08-3750.00	Rio Grande at Johnson Ranch near Castolon, Texas	IBWC	1936-2019	15 minutes
Brewster	08374550	Rio Grande near Castolon, Texas	USGS	2007-2019	Daily
Brewster	08375300	Rio Grande at Rio Grande Village, BBNP, Texas	USGS	2007-2019	Daily
Terrell	08447020	Independence Creek near Sheffield, Texas	USGS	1974-2019	Daily

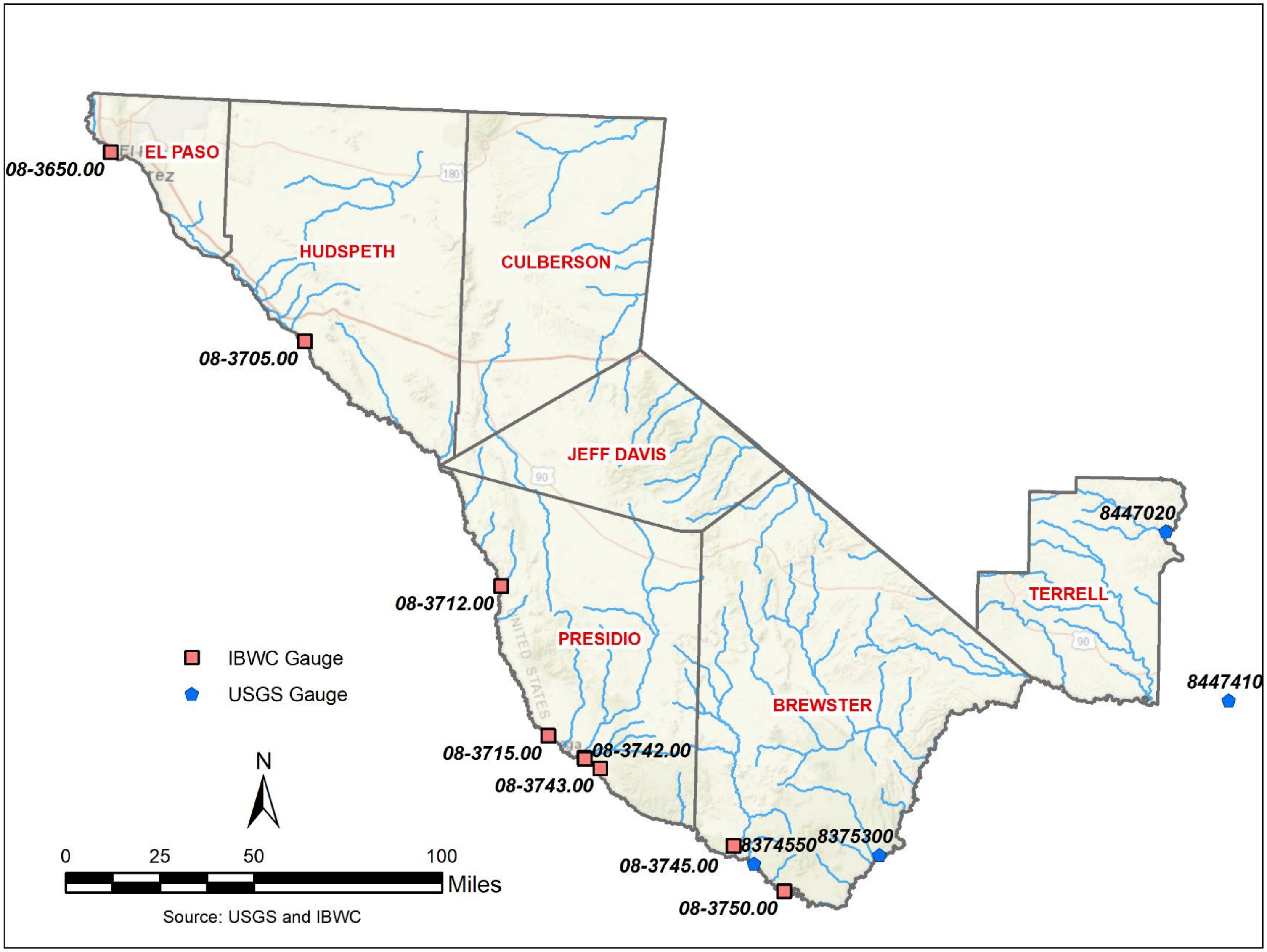

Figure 7-8. Selected Active Surface Water Gaging Locations

7.5.3 Regional Model Drought Contingency Plan

The Regional Model DCP summary Table 7-8 provides an overview of all existing regional water sources, WUGs, monitoring wells, gaging stations as well as recommended drought triggers and actions. The intent of including the monitoring wells and stations is to provide a comprehensive region-wide assessment of what current tools are available to WUGs and districts to monitor resources within the Region.

The Regional Model DCP will undoubtedly change over time to address particular needs and issues of the Region's users. Therefore, this initial version of the model plan will primarily focus on identifying all sources, users and monitoring tools to find the specific components within the Region that are not currently incorporated into any existing drought plan but could potentially utilize existing data resources. Another focus of this first model plan will consider consistency of existing plans within the Region. Entities that have adopted drought plans will only be assessed to this end, therefore fine-tuning existing triggers of existing municipal drought plans is not a goal of the model plan beyond an effort toward achieving consistent responses/actions to drought across the Region. No triggers have been recommended for modification; however, an effort has been made to make the percent reduction of demand/use a little more aggressive and more equitable across the board. Additionally, 'voluntary conservation' has been removed as a stage 1 action. Conservation is a BMP that ideally will ultimately be practiced on a daily basis, and not merely as a reaction to drought conditions, therefore it has been removed as an action in the Regional Model DCP.

Smaller PWS entities (county-other), manufacturing, power, and irrigation water wells that exceed GCD exempt well-production thresholds are subject to drought actions imposed by the conservation districts. Exempt well users are requested to voluntarily follow the actions specified by the Districts for non-exempt users. Generally, the water user groups within the Region that are *not* included in these plans (or included on a voluntary basis) are: 1) exempt water wells in counties with established GCDs, 2) users in Culberson and Hudspeth County outside of GCD boundaries, 3) and El Paso County users outside of EPW distribution system.

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Table 7-8. Recommended Regional Drought Plan Triggers and Actions

Source Name	Source Type	Source User Entity	Current WUG Monitoring	Real-time Source Monitoring	Triggers	Recommendations	Specific Actions (Percent Reduction Demand/ Use)							
							Source Manager				Users			
							1 Mild	2 Mod	3 Severe	4 Critical	1 Mild	2 Mod	3 Severe	4 Critical
Bone Spring - Victorio Peak	GW	*County Other* *Irrigation* *Livestock*	TWDB	48-07-516 (TWDB)	Trigger and monitoring wells in GCD Management Plan	Create a formal DCP with wells, triggers and responses	20	30	40	50	20	30	40	50
Capitan Reef Complex	GW	*Irrigation* *Mining* *Livestock*	N/A	N/A	Non-potable supply.	N/A	20	30	40	50	20	30	40	50
Edwards-Trinity (Plateau)	GW	Terrell County WCID #1 (Sanderson)	TWDB 53-53-804, 53-53-806, 53-53-809, 53-53-903	N/A	See Table 7-1	Create a formal DCP with wells, triggers and responses. Make stage 1 a mandatory 20% demand reduction.	20	30	40	50	20	30	40	50
		County Other - (Brewster, Culberson, Jeff Davis, Terrell) *Irrigation* *Livestock* *Mining*	N/A	N/A	Trigger and monitoring wells in GCD Management Plan	N/A	20	30	40	50	20	30	40	50
Hueco-Mesilla Bolson	GW	City of El Paso	N/A	49-04-476 (USGS), or 49-13-301 (TWDB)	See Table 7-1	Remove voluntary conservation as a stage. Make stage 1 a mandatory 20% demand reduction.	20	30	40	50	20	30	40	50
		City of Vinton			See Table 7-1 (EPW)	Follow El Paso triggers and actions.								
		Lower Valley Water District			See Table 7-1	Remove voluntary conservation as a stage. Make stage 1 a mandatory 20% demand reduction.	20	30	40	50	20	30	40	50
		Town of Clint			See Table 7-1 (LVWD)	Follow LVWD triggers and actions.	20	30	40	50	20	30	40	50
		City of San Elizario					20	30	40	50	20	30	40	50
		City of Socorro					20	30	40	50	20	30	40	50
		El Paso County Tornillo WID			See Table 7-1	Remove voluntary conservation as a stage. Make stage 1 a 20% demand reduction.	20	30	40	50	20	30	40	50
		El Paso County WCID #4			See Table 7-1	Remove voluntary conservation as a stage. Make stage 1 a 20% demand reduction.	20	30	40	50	20	30	40	50
Hueco-Mesilla Bolson	GW	Fort Bliss	N/A	49-04-476 (USGS), or 49-13-301 (TWDB)	See Table 7-1	Add triggers and actions for Stage 1 to achieve 20% demand reduction.	20	30	40	50	20	30	40	50
		Horizon Regional MUD			See Table 7-1	Remove voluntary conservation as a stage. Make stage 1 a 20% demand reduction.	20	30	40	50	20	30	40	50
		Town of Anthony			See Table 7-1	Remove voluntary conservation as a stage. Make stage 1 a 20% demand reduction.	20	30	40	50	20	30	40	50
		County Other *Manufacturing* *Mining* *Power* *Livestock*			N/A	N/A	20	30	40	50	20	30	40	50

Table 7-8. (Continued) Recommended Regional Drought Plan Triggers and Actions

Source Name	Source Type	Source User Entity	Current WUG Monitoring	Real-time Source Monitoring	Triggers	Recommendations	Specific Actions (Percent Reduction Demand/ Use)							
							Source Manager				Users			
							1	2	3	4	1	2	3	4
							Mild	Mod	Severe	Critical	Mild	Mod	Severe	Critical
Igneous	GW	City of Alpine	N/A	not needed	See Table 7-1	Remove voluntary conservation as a stage. Make stage 1 a 20% demand reduction.	20	30	40	50	20	30	40	50
		City of Marfa	51-48-602, 51-48-603	not needed	See Table 7-1	Remove voluntary conservation as a stage. Make stage 1 a 20% demand reduction.	20	30	40	50	20	30	40	50
		Fort Davis WSC	N/A	52-25-209 (TWDB)	See Table 7-1	Add triggers and actions for Stage 1 to achieve 20% demand reduction.	20	30	40	50	20	30	40	50
		County Other			Subject to GCD management plans.	N/A	Follow GCD recommendations.							
		Irrigation												
		Mining												
		Livestock												
Marathon	GW	Marathon WSSS	N/A	N/A	Subject to GCD management plans.	N/A	Follow GCD recommendations.							
		County Other												
		Livestock												
West Texas Bolsons	GW	City of Presidio	N/A	47-59-123 (TWDB)	See Table 7-1	Remove voluntary conservation as a stage. Make stage 1 a 20% demand reduction.	20	30	40	50	20	30	40	50
		City of Van Horn			See Table 7-1	Remove voluntary conservation as a stage. Make stage 1 a 20% demand reduction. Add triggers to DCP.	20	30	40	50	20	30	40	50
		Hudspeth County WCID #1 (Sierra Blanca)			No DCP submitted.	N/A	20	30	40	50	20	30	40	50
		County Other	N/A	51-29-805 (TWDB)	Subject to GCD management plans except in Hudspeth County	N/A	20	30	40	50	20	30	40	50
		Irrigation												
		Mining												
		Livestock												
Other - Rio Grande Alluvium (El Paso, Hudspeth)	GW	Horizon Regional MUD	N/A	N/A	See Table 7-1	Remove voluntary conservation as a stage. Make stage 1 a 20% demand reduction.	20	30	40	50	20	30	40	50
		Mining	N/A	N/A	N/A	N/A	20	30	40	50	20	30	40	50
		Irrigation												
Other - Volcanics (Brewster)	GW	*Mining*	N/A	73-47-404	Subject to GCD management plans.	N/A	Follow GCD recommendations.							
		Irrigation												
		Livestock												

Table 7-8. (Continued) Recommended Regional Drought Plan Triggers and Actions

<table>
<tr><th rowspan="4">Source Name</th><th rowspan="4">Source Type</th><th rowspan="4">Source User Entity</th><th rowspan="4">Current WUG Monitoring</th><th rowspan="4">Real-time Source Monitoring</th><th rowspan="4">Triggers</th><th rowspan="4">Recommendations</th><th colspan="8">Specific Actions (Percent Reduction Demand/ Use)</th></tr>
<tr><th colspan="4">Source Manager</th><th colspan="4">Users</th></tr>
<tr><th>1</th><th>2</th><th>3</th><th>4</th><th>1</th><th>2</th><th>3</th><th>4</th></tr>
<tr><th>Mild</th><th>Mod</th><th>Severe</th><th>Critical</th><th>Mild</th><th>Mod</th><th>Severe</th><th>Critical</th></tr>
<tr><td>Upper Rio Grande</td><td>SW</td><td>City of El Paso</td><td>EPCWID#1</td><td>USBR Elephant Butte Reservoir Dam</td><td>Subject to requirements mandated by the Rio Grande Project</td><td>No recommendations.</td><td colspan="8">No recommendations.</td></tr>
<tr><td rowspan="2">Lower Rio Grande</td><td rowspan="2">SW</td><td>Hudspeth County Irrigation</td><td></td><td>08-3705.00 Rio Grande at Old Fort Quitman, Texas</td><td>Subject to local mandates by irrigation district</td><td>No recommendations.</td><td colspan="8" rowspan="6">No recommendations</td></tr>
<tr><td>Presidio County Irrigation</td><td></td><td>IBWC 08-3742.00 Rio Grande below Rio Conchos near Presidio, TX

USGS 08375300 Rio Grande at Rio Grande Village, BBNP, Texas</td><td>Subject to local mandates by irrigation district</td><td>No recommendations.</td></tr>
<tr><td>Terlingua Creek</td><td>SW</td><td></td><td></td><td>IBWC 08-3745.00 Terlingua Creek near Terlingua, TX</td><td>N/A</td><td>No recommendations.</td></tr>
<tr><td>Pecos River</td><td>SW</td><td></td><td></td><td>IBWC 08-4474.10 Pecos River near Langtry, TX</td><td>N/A</td><td>No recommendations.</td></tr>
<tr><td>Independence Creek</td><td>SW</td><td></td><td></td><td>USGS 08447020 Independence Creek near Sheffield, TX</td><td>N/A</td><td>No recommendations.</td></tr>
<tr><td>Toyahville Springs</td><td>SW</td><td></td><td></td><td>USGS 08427000 Giffin Springs at Toyahville, TX</td><td>N/A</td><td>No recommendations.</td></tr>
</table>

7.5.4 Model Drought Contingency Plans

Model drought contingency plans were developed for the Far West Texas region and are included in Attachment 7-1. Each plan identifies four drought stages: mild, moderate, severe and emergency. The recommended responses range from notification of drought conditions and voluntary reductions in the "mild" stage to mandatory restrictions during an "emergency" stage. Entities using the model plan can select the trigger conditions for the different stages and appropriate responses for each stage.

In 2019, the Drought Preparedness Council recommended that a model DCP be in place for any water user group that exceeds ten percent of the Region's water demands. For Far West Texas, these user groups include irrigation and municipal. Based on this recommendation, model DCPs for municipal and irrigation users have been added.

Public Water Supplier

Drought contingency plans have previously been adopted by the majority public suppliers and municipalities in Far West Texas, although some suppliers did not provide any adopted plans. Current triggers and response actions for participating entities are summarized in Table 7-1. Recommended changes to existing response actions are detailed in Table 7-8.

Irrigation

Irrigation wells located within a municipality are subject to the triggers and response actions designated by the city's drought plan. Non-exempt irrigation wells located outside of a municipality but within a GCD are subject to the triggers and response actions of the GCD. Exempt irrigation wells located within a GCD are requested to comply voluntarily with response actions that have been mandated for non-exempt well owners. No response actions have been designated for irrigators located in El Paso County except for those located within the City of El Paso's jurisdictional boundary.

Major Water Provider

There are two major municipal water providers in the Far West Texas region:

- El Paso Water
- Lower Valley Water District

Currently adopted triggers and response actions for these providers are summarized in Table 7-9.

Table 7-9. Major Municipal Water Provider Drought Triggers and Response Actions

		Stage & Description				
WWP		**1 - Mild**	**2 - Moderate**	**3 - Severe**	**4 - Extreme**	**5 - Emergency**
El Paso Water	Trigger	EPCWID decreases allotment less than 0.5-acre foot per acre on or before April 1; water demand is projected to exceed EPWU system capacity.	EPCWID decreases allotment less than 1.0-acre foot per acre on or after April 1 but before May 1 or there is not a continuous release of surface water; water demand is projected to exceed EPWU system capacity.	EPCWID decreases allotment less than 1.5-acre foot per acre after May 1 but before May 15 or there is not a continuous release of surface water; water demand is projected to exceed EPWU system capacity.	N/A	N/A
El Paso Water	Conservation Goal (percent reduction in pumpage)	Voluntary-reduce water demand by 25%, public education and outreach.	Mandatory lawn watering schedule and permitting.	Set limits on water consumption; prohibit use of specific outdoor watering activities.	N/A	N/A
Lower Valley Water District	Trigger	Water stored in Elephant Butte Reservoir is less than 50,000 acre-feet; surface water allotment is less than or equal to 3.0 acre-ft./acre; or demand exceeds 90% system capacity.	Surface water allotment less than or equal to 2.5 acre-ft./acre; or demand exceeds 95% system capacity.	Surface water allotment less than or equal to 2.0 acre-ft./acre; or demand exceeds 100% system capacity.	N/A	Major system failures or supply contamination.
Lower Valley Water District	Conservation Goal (percent reduction in pumpage)	Voluntary- reduce landscape irrigation water use by 50%. No: aesthetic use (fountains), car washes, filling of pools, or pavement washing.	Voluntary- reduce industry water consumption by 25% No: planting except xeriscape, street-sweeping, City or County irrigation, plus all stage 1 restrictions.	All non-essential water use is prohibited.	N/A	Water rationing may be put into effect.

7.6 DROUGHT MANAGEMENT WATER MANAGEMENT STRATEGIES

Far West Texas does not consider drought management as a feasible strategy to meet long-term growth in demands or current needs. This strategy is considered a temporary measure aimed at conserving available water supplies during times of drought or emergencies. Drought management is most adequately addressed in the region through the implementation of local drought contingency plans. Far West Texas is supportive of the development and use of these plans during periods of drought or emergency water needs.

Average annual precipitation in Far West Texas varies from about eight inches a year in El Paso County to nearly 15 inches in Jeff Davis County. As a result, the Region is accustomed to managing water supplies in a dry environment. Thus, Far West Texas is probably the best prepared Regional Water Planning Area in in the State to manage their water resources during drought conditions.

7.7 OTHER DROUGHT-RELATED CONSIDERATIONS AND RECOMMENDATIONS

7.7.1 Texas Drought Preparedness Council and Drought Preparedness Plan

In accordance with TWDB rules, all relevant recommendations from the Drought Preparedness Council were considered in the writing of this Chapter. The Texas Drought Preparedness Council is composed of representatives from multiple State agencies and plays an important role in monitoring drought conditions, advising the governor and other groups on significant drought conditions, and facilitating coordination among local, State, and federal agencies in drought-response planning. The Council meets regularly to discuss drought indicators and conditions across the State and releases Situation Reports summarizing their findings. Additionally, the Council has developed the State Drought Preparedness Plan, which sets forth a framework for approaching drought in an integrated manner to minimize impacts to people and resources. Far West Texas supports the ongoing efforts of the Texas Drought Preparedness Council and recommends that water providers and other interested parties regularly review the Situation Reports as part of their drought monitoring procedures. The Council provided two new recommendations in 2019 to all RWPGs which are addressed in this chapter.

- Follow the outline template for Chapter 7 provided to the regions by Texas Water Development Board staff in April of 2019, making an effort to fully address the assessment of current drought preparations and planned responses, as well as planned responses to local drought conditions or loss of municipal supply.
- Develop region-specific model drought contingency plans for all water use categories in the region that account for more than 10 percent of water demands in any decade over the 50-year planning horizon.

To meet these recommendations, Far West Texas has developed this Chapter to correspond with the sections of the outline template and has provided model DCPs for both municipal and irrigation users.

7.7.2 Other Drought Recommendations

The Far West Texas Water Planning Group recognizes that while drought preparedness, including drought contingency plans (DCPs), are an important tool, in some instances, drought cannot be prepared for, it must be responded to. The Planning Group maintains that DCPs developed by the local, individual water providers are the best available tool for drought management and fully supports the use and implementation of individual DCPs during times of drought. The Planning Group has reviewed provided DCPs and specific drought response strategies proposed in this Plan and find no unnecessary or counterproductive variations to exist.

Drought in Far West Texas can be defined in three operational definitions; meteorologic, agricultural and hydrologic (see Chapter 1, Section 1.2.6). Because Far West Texas already exists in a meteorological environment that is significantly drier than the rest of the State, it is more logical to consider management strategies that address a diminished or lost water supply source. Primary sources include Rio Grande surface water and groundwater from numerous aquifers.

Rio Grande drought supply is largely the result of meteorological conditions in southern Colorado and New Mexico. Surface water drought management recommendations are:

- Continue to support the US Bureau of Reclamation - Rio Grande Project administration.
- Continue to financially support El Paso County WID#1 projects intended to prevent loss of water due to seepage in canals.
- Continue to legally support the justifiable delivery of apportioned water (Rio Grande Compact) across the New Mexico state line.
- Continue to legally support the justifiable delivery of apportioned water (Rio Grande International Treaty) across the international boundary.

Rural communities other than those in El Paso County are reliant on groundwater sources. Groundwater in Far West Texas is generally not immediately impacted by intermittent drought conditions as does surface water. Therefore, loss of supply is more of an infrastructure issue. Communities in these counties can mostly be classified as small to very small, with limited financial revenues. Thus, the biggest threat to a water-supply loss is the lack of a back-up source. Some communities have only one water-supply well and no interconnect options. The Far West Texas Water Planning Group thus recommends that state and federal agencies with rural-community relief functions provide grant funding opportunities to address this potential water-shortage predicament.

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APPENDIX 7A
MODEL DROUGHT CONTINGENCY PLANS

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Far West Texas
Model Drought Contingency Plan
for an Irrigation District
(adapted from TCEQ)

Irrigation District:	Click to add text	
Address:		
Telephone Number:	( )	Fax: ( )
Water Right No.(s):		
Regional Water Planning Group:		
Form Completed by:		
Title:		
Person responsible for implementation:		Phone: ( )
Signature:		Date: / /

Section I: Declaration of Policy, Purpose, and Intent

The Board of Directors of the _____ (*name of irrigation district*) deems it to be in the interest of the District to adopt Rules and Regulations governing the equitable and efficient allocation of limited water supplies during times of shortage. These Rules and Regulations constitute the District's drought contingency plan required under Section 11.1272, Texas Water Code, *Vernon's Texas Codes Annotated*, and associated administrative rules of the Texas Commission on Environmental Quality (Title 30, Texas Administrative Code, Chapter 288).

Section II: User Involvement

Opportunity for users of water from the _____ (*name of irrigation district*) was provided by means of _____ (*describe methods used to inform water users about the preparation of the plan and opportunities for input; for example, scheduling and providing notice of a public meeting to accept user input on the plan*).

Section III: User Education

The _____ (*name of irrigation district*) will periodically provide water users with information about the Plan, including information about the conditions under which water allocation is to be initiated or terminated and the district's policies and procedures for water allocation. This information will be provided by means of _____ (*example: describe methods to be used to provide water users with information about the Plan; for example, by providing copies of the Plan and by posting water allocation rules and regulations on the district's public bulletin board*).

Section IV: Authorization

The _____ (*example: general manager*) is hereby authorized and directed to implement the applicable provision of the Plan upon determination by the Board that such implementation is necessary to ensure the equitable and efficient allocation of limited water supplies during times of shortage.

Section V: Application

The provisions of the Plan shall apply to all persons utilizing water provided by the _____ (*name of irrigation district*). The term "person" as used in the Plan includes individuals, corporations, partnerships, associations, and all other legal entities.

Section VI: Initiation of Water Allocation

The _____ (*designated official*) shall monitor water supply conditions on a _____ (*example: weekly, monthly*) basis and shall make recommendations to the Board regarding irrigation of water allocation. Upon approval of the Board, water allocation will become effective when _____ (*describe the criteria and the basis for the criteria*):

Below are examples of the types of triggering criteria that might be used; singly or in combination, in an irrigation district's drought contingency plan:

Example 1: Water in storage in the _____ (*name of reservoir*) is equal to or less than _____ (*acre-feet and/or percentage of storage capacity*).

Example 2: Combined storage in the _____ (*name or reservoirs*) reservoir system is equal to or less than _____ (*acre-feet and/or percentage of storage capacity*).

Example 3: Flows as measured by the U.S. Geological Survey gage on the _____ (*name of reservoir*) near _____, Texas reaches _____ cubic feet per second (cfs).

Example 4: The storage balance in the district's irrigation water rights account reaches _____ acre-feet.

Example 5: The storage balance in the district's irrigation water rights account reaches an amount equivalent to _____ (*number*) irrigations for each flat rate acre in which all flat rate assessments are paid and current.

Example 6: The _____ (*name of entity supplying water to the irrigation district*) notifies the district that water deliveries will be limited to _____ acre-feet per year (*i.e. a level below that required for unrestricted irrigation*).

Section VII: Termination of Water Allocation

The district's water allocation policies will remain in effect until the conditions defined in Section IV of the Plan no longer exist and the Board deems that the need to allocate water no longer exists.

Section VIII: Notice

Notice of the initiation of water allocation will be given by notice posted on the District's public bulletin board and by mail to each _____ (*example: landowner, holders of active irrigation accounts, etc.*).

Section IX: Water Allocation

(a) In identifying **specific, quantified targets** for water allocation to be achieved during periods of water shortages and drought, each irrigation user shall be allocated _____ irrigations or _____ acre-feet of water each flat rate acre on which all taxes, fees, and charges have been paid. The water allotment in each irrigation account will be expressed in acre-feet of water.

Include explanation of water allocation procedure. For example, in the Lower Rio Grande Valley, an "irrigation" is typically considered to be equivalent to eight (8) inches of water per irrigation acre; consisting of six (6) inches of water per acre applied plus two (2) inches of water lost in transporting the water from the river to the land. Thus, three irrigations would be equal to 24 inches of water per acre or an allocation of 2.0 acre-feet of water measured at the diversion from the river.

(b) As additional water supplies become available to the District in an amount reasonably sufficient for allocation to the District's irrigation users, the additional water made available to the District will be equally distributed, on a pro rata basis, to those irrigation users having _____.

Example 1: An account balance of less than _____ irrigations for each flat rate acre (*i.e.* _____ *acre-feet*).

Example 2: An account balance of less than _____ acre-feet of water for each flat rate acre.

Example 3: An account balance of less than _____ acre-feet of water.

(c) The amount of water charged against a user's water allocation will be _____ (*example: eight inches*) per irrigation, or one allocation unit, unless water deliveries to the land are metered. Metered water deliveries will be charges based on actual measured use. In order to maintain parity in charging use against a water allocation between non-metered and metered deliveries, a loss factor of _____ percent of the water delivered in a metered situation will be added to the measured use and will be charged against the user's water allocation. Any metered use, with the loss factor applied, that is less than eight (8) inches per acre shall be credited back to the allocation unit and will be available to the user. It shall be a violation of the Rules and Regulations for a water user to use water in excess of the amount of water contained in the user's irrigation account.

(d) Acreage in an irrigation account that has not been irrigated for any reason within the last two (2) consecutive years will be considered inactive and will not be allocated water. Any landowner whose land has not been irrigated within the last two (2) consecutive years, may, upon application to the District expressing intent to irrigate the land, receive future allocations. However, irrigation water allocated shall be applied only upon the acreage to which it was allocated and such water allotment cannot be transferred until there have been two consecutive years of use.

Section X: Transfers of Allotments

(a) A water allocation in an active irrigation account may be transferred within the boundaries of the District from one irrigation account to another. The transfer of water can only be made by the landowner's agent who is authorized in writing to act on behalf of the landowner in the transfer of all or part of the water allocation from the described land of the landowner covered by the irrigation account.

(b) A water allocation may not be transferred to land owned by a landowner outside the District boundaries.

or

A water allocation may be transferred to land outside the District's boundaries by paying the current water charge as if the water was actually delivered by the District to the land covered by an irrigation account. The amount of water allowed to be transferred shall be stated in terms of acre-feet and deducted from the landowner's current allocation balance in the irrigation account. Transfers of water outside the District shall not affect the allocation of water under Section VII of these Rules and Regulations.

(c) Water from outside the District may not be transferred by a landowner for use within the District.

or

Water from outside the District may be transferred by a landowner for use within the District. The District will divert and deliver the water on the same basis as District water is delivered, except that a _____ percent conveyance loss will be charged against the amount of water transferred for use in the District as the water is delivered.

Section XI: Penalties

Any person who willfully opens, closes, changes or interferes with any headgate or uses water in violation of these Rules and Regulations, shall be considered in violation of Section 11.0083, Texas Water Code, *Vernon's Texas Codes Annotated*, which provides for punishment by fine of not less than $10.00 nor more than $200.00 or by confinement in the county jail for not more than thirty (30) days, or both, for each violation, and these penalties provided by the laws of the State and may by enforced by complaints filed in the appropriate court jurisdiction in _____ County, all in accordance with Section 11.083; and in addition, the District may pursue a civil remedy in the way of damages and/or injunction against the violation of any of the foregoing Rules and Regulations.

Section XII: Severability

It is hereby declared to be the intention of the Board of Directors of the _____ (*name of irrigation district*) that the sections, paragraphs, sentences, clauses, and phrases of this Plan shall be declared unconstitutional by the valid judgment or decree of any court of competent jurisdiction, such unconstitutionality shall not affect any of the remaining phrases, clauses, sentences, paragraphs, and sections of this Plan, since the same would not have been enacted by the Board without the incorporation into this Plan of any such unconstitutional phrase, clause, sentence, paragraph, or section.

Section XIII: Authority

The foregoing rules and regulations are adopted pursuant to and in accordance with Sections 11.039, 11.083, 11.1272; Section 49.004; and Section 58.127-130 of the Texas Water Code, *Vernon's Texas Codes Annotated.*

Section XIV: Effective Date of Plan

The effective date of this Rule shall be five (5) days following the date of Publication hereof and ignorance of the Rules and Regulations is not a defense for a prosecution for enforcement of the violation of the Rules and Regulations.

Far West Texas
Drought Contingency Plan
for a Retail Public Water Supplier

(Adapted from TCEQ)

Name:	Click to add text	
Address:		
Telephone Number:	( )	Fax: ( )
Water Right No.(s):		
Regional Water Planning Group:		
Form Completed by:		
Title:		
Person responsible for implementation:		Phone: ( )
Signature:		Date: / /

Section I: Declaration of Policy, Purpose, and Intent

In order to conserve the available water supply and protect the integrity of water supply facilities, with particular regard for domestic water use, sanitation, and fire protection, and to protect and preserve public health, welfare, and safety and minimize the adverse impacts of water supply shortage or other water supply emergency conditions, the _____ (*name of your water supplier*) hereby adopts the following regulations and restrictions on the delivery and consumption of water.

Water uses regulated or prohibited under this Drought Contingency Plan (the Plan) are considered to be non-essential and continuation of such uses during times of water shortage or other emergency water supply condition are deemed to constitute a waste of water which subjects the offender(s) to penalties as defined in Section X of this Plan.

Section II: Public Involvement

Opportunity for the public to provide input into the preparation of the Plan was provided by the _____ (*name of your water supplier*) by means of _____ (*describe methods used to inform the public about the preparation of the plan and provide opportunities for input; for example, scheduling and providing public notice of a public meeting to accept input on the Plan*).

Section III: Public Education

The _____ (*name of your water supplier*) will periodically provide the public with information about the Plan, including information about the conditions under which each stage of the Plan is to be initiated or terminated and the drought response measures to be implemented in each stage. This information will be provided by means of _____ (*describe methods to be used to* *provide information to the public about the Plan; for example, public events, press releases or utility bill inserts*).

Section IV: Coordination with Regional Water Planning Groups
The service area of the _____ (*name of your water supplier*) is located within the _____ (*name of regional water planning area or areas*) and _____ (*name of your water supplier*) has provided a copy of this Plan to the _____ (*name of your regional water planning group or groups*).

Section V: Authorization
The _____ (*designated official; for example, the mayor, city manager, utility director, general manager, etc.*), or his/her designee is hereby authorized and directed to implement the applicable provisions of this Plan upon determination that such implementation is necessary to protect public health, safety, and welfare. The _____ (*designated official*) or his/her designee shall have the authority to initiate or terminate drought or other water supply emergency response measures as described in this Plan.

Section VI: Application
The provisions of this Plan shall apply to all persons, customers, and property utilizing water provided by the _____ (*name of your water supplier*). The terms "person" and "customer" as used in the Plan include individuals, corporations, partnerships, associations, and all other legal entities.

Section VII: Definitions
For the purposes of this Plan**,** the following definitions shall apply:

<u>Aesthetic water use</u>: water use for ornamental or decorative purposes such as fountains, reflecting pools, and water gardens.

<u>Commercial and institutional water use</u>: water use which is integral to the operations of commercial and non-profit establishments and governmental entities such as retail establishments, hotels and motels, restaurants, and office buildings.

<u>Conservation</u>: those practices, techniques, and technologies that reduce the consumption of water, reduce the loss or waste of water, improve the efficiency in the use of water or increase the recycling and reuse of water so that a supply is conserved and made available for future or alternative uses.

<u>Customer</u>: any person, company, or organization using water supplied by _____ (*name of your water supplier*).

<u>Domestic water use</u>: water use for personal needs or for household or sanitary purposes such as drinking, bathing, heating, cooking, sanitation, or for cleaning a residence, business, industry, or institution.

<u>Even number address</u>: street addresses, box numbers, or rural postal route numbers ending in 0, 2, 4, 6, or 8 and locations without addresses.

<u>Industrial water use</u>: the use of water in processes designed to convert materials of lower value into forms having greater usability and value.

Landscape irrigation use: water used for the irrigation and maintenance of landscaped areas, whether publicly or privately owned, including residential and commercial lawns, gardens, golf courses, parks, and rights-of-way and medians.

Non-essential water use: water uses that are not essential nor required for the protection of public, health, safety, and welfare, including:

(a) irrigation of landscape areas, including parks, athletic fields, and golf courses, except otherwise provided under this Plan;
(b) use of water to wash any motor vehicle, motorbike, boat, trailer, airplane or other vehicle;
(c) use of water to wash down any sidewalks, walkways, driveways, parking lots, tennis courts, or other hard-surfaced areas;
(d) use of water to wash down buildings or structures for purposes other than immediate fire protection;
(e) flushing gutters or permitting water to run or accumulate in any gutter or street;
(f) use of water to fill, refill, or add to any indoor or outdoor swimming pools or Jacuzzi-type pools;
(g) use of water in a fountain or pond for aesthetic or scenic purposes except where necessary to support aquatic life;
(h) failure to repair a controllable leak(s) within a reasonable period after having been given notice directing the repair of such leak(s); and
(i) use of water from hydrants for construction purposes or any other purposes other than fire fighting.

Odd numbered address: street addresses, box numbers, or rural postal route numbers ending in 1, 3, 5, 7, or 9.

Section VIII: Criteria for Initiation and Termination of Drought Response Stages

The _____ (*designated official*) or his/her designee shall monitor water supply and/or demand conditions on a _____ (*example: daily, weekly, monthly*) basis and shall determine when conditions warrant initiation or termination of each stage of the Plan, that is, when the specified "triggers" are reached.

The triggering criteria described below are based on:
_____.
(*Provide a brief description of the rationale for the triggering criteria; for example, triggering criteria / trigger levels based on a statistical analysis of the vulnerability of the water source under drought of record conditions, or based on known system capacity limits*).

Utilization of alternative water sources and/or alternative delivery mechanisms:

Alternative water source(s) for _____ (*name of utility*) is/are: _____.
(Examples: Other well(s), Inter-connection with other system, Temporary use of a non-municipal water supply, Purchased water, Use of reclaimed water for non-potable purposes, etc.).

Stage 1 Triggers -- MILD Water Shortage Conditions

Requirements for initiation
Customers shall be requested to voluntarily conserve water and adhere to the prescribed restrictions on certain water uses, defined in Section VII Definitions, when _____.
(*Describe triggering criteria / trigger levels; see examples below*).

Following are examples of the types of triggering criteria that might be used <u>in one or more successive stages</u> of a drought contingency plan. The public water supplier may devise other triggering criteria and an appropriate number of stages tailored to its system. One or a combination of the criteria selected by the public water supplier must be defined for each drought response stage, but usually <u>not all will apply</u>.

Example 1: *Annually, beginning on May 1 through September 30.*

Example 2: *When the water supply available to the _____ (name of your water supplier) is equal to or less than _____ (acre-feet, percentage of storage, etc.).*

Example 3: *When, pursuant to requirements specified in the _____ (name of **your** water supplier) wholesale water purchase contract with _____ (name of your wholesale water supplier), notification is received requesting initiation of Stage 1 of the Drought Contingency Plan.*

Example 4: *When flows in the _____ (name of stream or river) are equal to or less than _____ cubic feet per second.*

Example 5: *When the static water level in the _____ (name of your water supplier) well(s) is equal to or less than _____ feet above/below mean sea level.*

Example 6: *When the specific capacity of the _____ (name of your water supplier) well(s) is equal to or less than _____ percent of the well's original specific capacity.*

Example 7: *When total daily water demand equals or exceeds _____ million gallons for _____ consecutive days of _____ million gallons on a single day (example: based on the safe operating capacity of water supply facilities).*

Example 8: *Continually falling treated water reservoir levels which do not refill above _____ percent overnight (example: based on an evaluation of minimum treated water storage required to avoid system outage).*

<u>Requirements for termination</u>
Stage 1 of the Plan may be rescinded when all of the conditions listed as triggering events have ceased to exist for a period of _____ (*example: 3*) consecutive days.

Stage 2 Triggers – MODERATE Water Shortage Conditions

<u>Requirements for initiation</u>
Customers shall be required to comply with the requirements and restrictions on certain non-essential water uses provided in Section IX of this Plan when _____ (*describe triggering criteria; see examples in Stage 1*).

<u>Requirements for termination</u>
Stage 2 of the Plan may be rescinded when all of the conditions listed as triggering events have ceased to exist for a period of _____ (*example: 3*) consecutive days. Upon termination of Stage 2, Stage 1, or the applicable drought response stage based on the triggering criteria, becomes operative.

Stage 3 Triggers – SEVERE Water Shortage Conditions

Requirements for initiation
Customers shall be required to comply with the requirements and restrictions on certain non-essential water uses for Stage 3 of this Plan when _____ (*describe triggering criteria; see examples in Stage 1*).

Requirements for termination
Stage 3 of the Plan may be rescinded when all of the conditions listed as triggering events have ceased to exist for a period of _____ (*example: 3*) consecutive days. Upon termination of Stage 3, Stage 2, or the applicable drought response stage based on the triggering criteria, becomes operative.

Stage 4 Triggers – CRITICAL Water Shortage Conditions

Requirements for initiation
Customers shall be required to comply with the requirements and restrictions on certain non-essential water uses for Stage 4 of this Plan when _____ (*describe triggering criteria; see examples in Stage 1*).

Requirements for termination
Stage 4 of the Plan may be rescinded when all of the conditions listed as triggering events have ceased to exist for a period of _____ (*example: 3*) consecutive days. Upon termination of Stage 4, Stage 3, or the applicable drought response stage based on the triggering criteria, becomes operative.

Stage 5 Triggers – EMERGENCY Water Shortage Conditions

Requirements for initiation
Customers shall be required to comply with the requirements and restrictions for Stage 5 of this Plan when _____ (*designated official*), or his/her designee, determines that a water supply emergency exists based on:

1. Major water line breaks, or pump or system failures occur, which cause unprecedented loss of capability to provide water service; **or**

2. Natural or man-made contamination of the water supply source(s).

Requirements for termination
Stage 5 of the Plan may be rescinded when all of the conditions listed as triggering events have ceased to exist for a period of _____ (*example: 3*) consecutive days.

Stage 6 Triggers – WATER ALLOCATION

Requirements for initiation
Customers shall be required to comply with the water allocation plan prescribed in Section IX of this Plan and comply with the requirements and restrictions for Stage 5 of this Plan when _____ (*describe triggering criteria, see examples in Stage 1*).

Requirements for termination - Water allocation may be rescinded when all of the conditions listed as triggering events have ceased to exist for a period of _____ (*example: 3*) consecutive days.

Note: The inclusion of WATER ALLOCATION as part of a drought contingency plan may not be required in all cases. For example, for a given water supplier, an analysis of water supply availability under drought of record conditions may indicate that there is essentially no risk of water supply shortage. Hence, a drought contingency plan for such a water supplier might only address facility capacity limitations and emergency conditions (example: supply source contamination and system capacity limitations).

Section IX: Drought Response Stages

The _____ (*designated official*), or his/her designee, shall monitor water supply and/or demand conditions on a daily basis and, in accordance with the triggering criteria set forth in Section VIII of this Plan, shall determine that a mild, moderate, severe, critical, emergency or water shortage condition exists and shall implement the following notification procedures:

Notification

Notification of the Public:

The _____ (*designated official*) or his/ her designee shall notify the public by means of:

Examples:
publication in a newspaper of general circulation,
direct mail to each customer,
public service announcements,
signs posted in public places
take-home fliers at schools.

Additional Notification:

The _____ (*designated official*) or his/ her designee shall notify directly, or cause to be notified directly, the following individuals and entities:

Examples:
Mayor / Chairman and members of the City Council / Utility Board
Fire Chief(s)
City and/or County Emergency Management Coordinator(s)
County Judge & Commissioner(s)
State Disaster District / Department of Public Safety
TCEQ *(required when* mandatory *restrictions are imposed)*
Major water users
Critical water users, i.e. hospitals
Parks / street superintendents & public facilities managers

Note: The plan should specify direct notice only as appropriate to respective drought stages.

Stage 1 Response – MILD Water Shortage Conditions

Target: Achieve a voluntary _____ percent reduction in _____ (*example: total water use, daily water demand, etc.*).

Best Management Practices for Supply Management:

D*escribe additional measures, if any, to be implemented directly by (name of your water supplier) to manage limited water supplies and/or reduce water demand.*

Examples include: system water loss control, activation and use of an alternative supply source(s); use of reclaimed water for non-potable purposes.

Voluntary Water Use Restrictions for Reducing Demand:

(a) Water customers are requested to voluntarily limit the irrigation of landscaped areas to Sundays and Thursdays for customers with a street address ending in an even number (0, 2, 4, 6 or 8), and Saturdays and Wednesdays for water customers with a street address ending in an odd number (1, 3, 5, 7 or 9), and to irrigate landscapes only between the hours of midnight and 10:00 a.m. and 8:00 p.m. to midnight on designated watering days.

(b) All operations of the _____ (*name of your water supplier*) shall adhere to water use restrictions prescribed for Stage 1 of the Plan.

(c) Water customers are requested to practice water conservation and to minimize or discontinue water use for non-essential purposes.

Stage 2 Response – MODERATE Water Shortage Conditions

Target: Achieve a _____ percent reduction in _____ (*example: total water use, daily water demand, etc.*).

Best Management Practices for Supply Management:

Describe additional measures, if any, to be implemented directly by _____ (name of your water supplier) to manage limited water supplies and/or reduce water demand. Examples include: system water loss control, reduced or discontinued irrigation of public landscaped areas; use of an alternative supply source(s); use of reclaimed water for non-potable purposes.

Water Use Restrictions for Demand Reduction:
Under threat of penalty for violation, the following water use restrictions shall apply to all persons:

(a) Irrigation of landscaped areas with hose-end sprinklers or automatic irrigation systems shall be limited to Sundays and Thursdays for customers with a street address ending in an even number (0, 2, 4, 6 or 8), and Saturdays and Wednesdays for water customers with a street address ending in an odd number (1, 3, 5, 7 or 9), and irrigation of landscaped areas is further limited to the hours of 12:00 midnight until 10:00 a.m. and between 8:00 p.m. and 12:00 midnight on designated watering days. However, irrigation of landscaped areas is permitted at anytime if it is by means of a hand-held hose, a faucet filled bucket or watering can of five (5) gallons or less, or drip irrigation system.

(b) Use of water to wash any motor vehicle, motorbike, boat, trailer, airplane or other vehicle is prohibited except on designated watering days between the hours of 12:00 midnight and 10:00 a.m. and between 8:00 p.m. and 12:00 midnight. Such washing, when allowed, shall be done with a hand-held bucket or a hand-held hose equipped with a positive shutoff nozzle for quick rises. Vehicle washing may be done at any time on the immediate premises of a commercial car wash or commercial service station. Further, such washing may be exempted from these regulations if the health, safety, and welfare of the public is contingent upon frequent vehicle cleansing, such as garbage trucks and vehicles used to transport food and perishables.

(c) Use of water to fill, refill, or add to any indoor or outdoor swimming pools, wading pools, or Jacuzzi-type pools is prohibited except on designated watering days between the hours of 12:00 midnight and 10:00 a.m. and between 8 p.m. and 12:00 midnight.

(d) Operation of any ornamental fountain or pond for aesthetic or scenic purposes is prohibited except where necessary to support aquatic life or where such fountains or ponds are equipped with a recirculation system.

(e) Use of water from hydrants shall be limited to fire fighting, related activities, or other activities necessary to maintain public health, safety, and welfare, except that use of water from designated fire hydrants for construction purposes may be allowed under special permit from the _____ (*name of your water supplier*).

(f) Use of water for the irrigation of golf course greens, tees, and fairways is prohibited except on designated watering days between the hours 12:00 midnight and 10:00 a.m. and between 8 p.m. and 12:00 midnight. However, if the golf course utilizes a water source other than that provided by the _____ (*name of your water supplier*), the facility shall not be subject to these regulations.

(g) All restaurants are prohibited from serving water to patrons except upon request of the patron.

(h) The following uses of water are defined as non-essential and are prohibited:

1. wash down of any sidewalks, walkways, driveways, parking lots, tennis courts, or other hard-surfaced areas;
2. use of water to wash down buildings or structures for purposes other than immediate fire protection;
3. use of water for dust control;
4. flushing gutters or permitting water to run or accumulate in any gutter or street; and
5. failure to repair a controllable leak(s) within a reasonable period after having been given notice directing the repair of such leak(s).

Stage 3 Response – SEVERE Water Shortage Conditions

Target: Achieve a _____ percent reduction in _____ (*example: total water use, daily water demand, etc.*).

Best Management Practices for Supply Management:

Describe additional measures, if any, to be implemented directly by _____ (name of your water supplier) to manage limited water supplies and/or reduce water demand. Examples include: system water loss control, reduced or discontinued irrigation of public landscaped areas; use of an alternative supply source(s); use of reclaimed water for non-potable purposes.

Water Use Restrictions for Demand Reduction:
All requirements of Stage 2 shall remain in effect during Stage 3 except:

(a) Irrigation of landscaped areas shall be limited to designated watering days between the hours of 12:00 midnight and 10:00 a.m. and between 8 p.m. and 12:00 midnight and shall be by means of hand-held hoses, hand-held buckets, drip irrigation, or permanently installed automatic sprinkler system only. The use of hose-end sprinklers is prohibited at all times.

(b) The watering of golf course tees is prohibited unless the golf course utilizes a water source other than that provided by the _____ (*name of your water supplier*).

(c) The use of water for construction purposes from designated fire hydrants under special permit is to be discontinued.

Stage 4 Response – CRITICAL Water Shortage Conditions

Target: Achieve a _____ percent reduction in _____ (*example: total water use, daily water demand, etc.*).

Best Management Practices for Supply Management:

Describe additional measures, if any, to be implemented directly by _____ (name of your water supplier) to manage limited water supplies and/or reduce water demand. Examples include: system water loss control, reduced or discontinued irrigation of public landscaped areas; use of an alternative supply source(s); use of reclaimed water for non-potable purposes.

Water Use Restrictions for Reducing Demand:
All requirements of Stage 2 and 3 shall remain in effect during Stage 4 except:

(a) Irrigation of landscaped areas shall be limited to designated watering days between the hours of 6:00 a.m. and 10:00 a.m. and between 8:00 p.m. and 12:00 midnight and shall be by means of hand-held hoses, hand-held buckets, or drip irrigation only. The use of hose-end sprinklers or permanently installed automatic sprinkler systems are prohibited at all times.

(b) Use of water to wash any motor vehicle, motorbike, boat, trailer, airplane or other vehicle not occurring on the premises of a commercial car wash and commercial service stations and not in the immediate interest of public health, safety, and welfare is prohibited. Further, such vehicle washing at commercial car washes and commercial service stations shall occur only between the hours of 6:00 a.m. and 10:00 a.m. and between 6:00 p.m. and 10 p.m.

(c) The filling, refilling, or adding of water to swimming pools, wading pools, and Jacuzzi-type pools is prohibited.

(d) Operation of any ornamental fountain or pond for aesthetic or scenic purposes is prohibited except where necessary to support aquatic life or where such fountains or ponds are equipped with a recirculation system.

(e) No application for new, additional, expanded, or increased-in-size water service connections, meters, service lines, pipeline extensions, mains, or water service facilities of any kind shall be approved, and time limits for approval of such applications are hereby suspended for such time as this drought response stage or a higher-numbered stage shall be in effect.

Stage 5 Response – EMERGENCY Water Shortage Conditions

<u>Target</u>: Achieve a _____ percent reduction in _____ (*example: total water use, daily water demand, etc.*).

<u>Best Management Practices for Supply Management</u>:

Describe additional measures, if any, to be implemented directly by _____ (name of your water supplier) to manage limited water supplies and/or reduce water demand. Examples include: system water loss control, reduced or discontinued irrigation of public landscaped areas; use of an alternative supply source(s); use of reclaimed water for non-potable purposes.

<u>Water Use Restrictions for Reducing Demand:</u>
All requirements of Stage 2, 3, and 4 shall remain in effect during Stage 5 except:

(a) Irrigation of landscaped areas is absolutely prohibited.

(b) Use of water to wash any motor vehicle, motorbike, boat, trailer, airplane or other vehicle is absolutely prohibited.

Stage 6 Response – WATER ALLOCATION

In the event that water shortage conditions threaten public health, safety, and welfare, the _____ (*designated official*) is hereby authorized to allocate water according to the following water allocation plan:

Single-Family Residential Customers

The allocation to residential water customers residing in a single-family dwelling shall be as follows:

Persons per Household	**Gallons per Month**
1 or 2	6,000
3 or 4	7,000
5 or 6	8,000
7 or 8	9,000
9 or 10	10,000
11 or more	12,000

"Household" means the residential premises served by the customer's meter. "Persons per household" include only those persons currently physically residing at the premises and expected to reside there for the entire billing period. It shall be assumed that a particular customer's household is comprised of two (2) persons unless the customer notifies the _____ (*name of your water supplier*) of a greater number of persons per household on a form prescribed by the _____ (*designated official*). The _____ (*designated official*) shall give his/her best effort to see that such forms are mailed, otherwise provided, or made available to every residential customer. If, however, a customer does not receive such a form, it shall be the customer's responsibility to go to the _____ (*name of your water supplier*) offices to complete and sign the form claiming more than two (2) persons per household. New customers may claim more persons per household at the time of applying for water service on the form prescribed by the _____ (*designated official*). When the number of persons per household increases so as to place the customer in a different allocation category, the customer may notify the _____ (*name of water supplier*) on such form and the change will be implemented in the next practicable billing period. If the number of persons in a household is reduced, the customer shall notify the _____ (*name of your water supplier*) in writing within two (2) days. In prescribing the method for claiming more than two (2) persons per household, the _____ (*designated official*) shall adopt methods to insure the accuracy of the claim. Any person who knowingly, recklessly, or with criminal negligence falsely reports the number of persons in a household or fails to timely notify the _____ (*name of your water supplier*) of a reduction in the number of person in a household shall be fined not less than $_____.

Residential water customers shall pay the following surcharges:

$_____ for the first 1,000 gallons over allocation.
$_____ for the second 1,000 gallons over allocation.
$_____ for the third 1,000 gallons over allocation.
$_____ for each additional 1,000 gallons over allocation.

Surcharges shall be cumulative.

Master-Metered Multi-Family Residential Customers

The allocation to a customer billed from a master meter which jointly measures water to multiple permanent residential dwelling units (example: apartments, mobile homes) shall be allocated 6,000 gallons per month for each dwelling unit. It shall be assumed that such a customer's meter serves two dwelling units unless the customer notifies the _____ (*name of your water supplier*) of a greater number on a form prescribed by the _____ (*designated official*). The _____ (*designated official*) shall give his/her best effort to see that such forms are mailed, otherwise provided, or made available to every such customer. If, however, a customer does not receive such a form, it shall be the customer's responsibility to go to the _____ (*name of your water supplier*) offices to complete and sign the form claiming more than two (2) dwellings. A dwelling unit may be claimed under this provision whether it is occupied or not. New customers may claim more dwelling units at the time of applying for water service on the form prescribed by the _____ (*designated official*). If the number of dwelling units served by a master meter is reduced, the customer shall notify the _____ (*name of your water supplier*) in writing within two (2) days. In prescribing the method for claiming more than two (2) dwelling units, the _____ (*designated official*) shall adopt methods to insure the accuracy of the claim. Any person who knowingly, recklessly, or with criminal negligence falsely reports the number of dwelling units served by a master meter or fails to timely notify the _____ (*name of your water supplier*) of a reduction in the number of person in a household shall be fined not less than $_____. Customers billed from a master meter under this provision shall pay the following monthly surcharges:

$_____ for 1,000 gallons over allocation up through 1,000 gallons for each dwelling unit.
$_____, thereafter, for each additional 1,000 gallons over allocation up through a second 1,000 gallons for each dwelling unit.
$_____, thereafter, for each additional 1,000 gallons over allocation up through a third 1,000 gallons for each dwelling unit.
$_____, thereafter for each additional 1,000 gallons over allocation.

Surcharges shall be cumulative.

Commercial Customers

A monthly water allocation shall be established by the _____ (*designated official*), or his/her designee, for each nonresidential commercial customer other than an industrial customer who uses water for processing purposes. The non-residential customer's allocation shall be approximately _____ (*example: 75%*) percent of the customer's usage for corresponding month's billing period for the previous 12 months. If the customer's billing history is shorter than 12 months, the monthly average for the period for which there is a record shall be used for any monthly period for which no history exists. Provided, however, a customer, _____ percent of whose monthly usage is less than _____ gallons, shall be allocated _____ gallons. The _____ (*designated official*) shall give his/her best effort to see that notice of each non-residential customer's allocation is mailed to such customer. If, however, a customer does not receive such notice, it shall be the customer's responsibility to contact the _____ (*name of your water supplier*) to determine the allocation. Upon request of the customer or at the initiative of the _____ (*designated official*), the allocation may be reduced or increased if, (1) the designated period does not accurately reflect the customer's normal water usage, (2) one nonresidential customer agrees to transfer part of its allocation to another nonresidential customer, or (3) other objective evidence demonstrates that the designated allocation is inaccurate under present conditions. A customer may appeal an allocation established hereunder to the _____ (*designated official or alternatively, a special water allocation review committee*). Nonresidential commercial customers shall pay the following surcharges:

Customers whose allocation is _____ gallons through _____ gallons per month:

$_____ per thousand gallons for the first 1,000 gallons over allocation.
$_____ per thousand gallons for the second 1,000 gallons over allocation.
$_____ per thousand gallons for the third 1,000 gallons over allocation.
$_____ per thousand gallons for each additional 1,000 gallons over allocation.

Customers whose allocation is _____ gallons per month or more:

_____ times the block rate for each 1,000 gallons in excess of the allocation up through 5 percent above allocation.
_____ times the block rate for each 1,000 gallons from 5 percent through 10 percent above allocation.
_____ times the block rate for each 1,000 gallons from 10 percent through 15 percent above allocation.
_____ times the block rate for each 1,000 gallons more than 15 percent above allocation.

The surcharges shall be cumulative. As used herein, "block rate" means the charge to the customer per 1,000 gallons at the regular water rate schedule at the level of the customer's allocation.

Industrial Customers

A monthly water allocation shall be established by the _____ (*designated official*), or his/her designee, for each industrial customer, which uses water for processing purposes. The industrial customer's allocation shall be approximately _____ (*example: 90%*) percent of the customer's water usage baseline. Ninety (90) days after the initial imposition of the allocation for industrial customers, the industrial customer's allocation shall be further reduced to _____ (*example: 85%*) percent of the customer's water usage baseline. The industrial customer's water use baseline will be computed on the average water use for the _____ month period ending prior to the date of implementation of Stage 2 of the Plan. If the industrial water customer's billing history is shorter than _____ months, the monthly average for the period for which there is a record shall be used for any monthly period for which no billing history exists. The _____ (*designated official*) shall give his/her best effort to see that notice of each industrial customer's allocation is mailed to such customer. If, however, a customer does not receive such notice, it shall be the customer's responsibility to contact the _____ (*name of your water supplier*) to determine the allocation, and the allocation shall be fully effective notwithstanding the lack of receipt of written notice. Upon request of the customer or at the initiative of the _____ (*designated official*), the allocation may be reduced or increased, (1) if the designated period does not accurately reflect the customer's normal water use because the customer had shutdown a major processing unit for repair or overhaul during the period, (2) the customer has added or is in the process of adding significant additional processing capacity, (3) the customer has shutdown or significantly reduced the production of a major processing unit, (4) the customer has previously implemented significant permanent water conservation measures such that the ability to further reduce water use is limited, (5) the customer agrees to transfer part of its allocation to another industrial customer, or (6) if other objective evidence demonstrates that the designated allocation is inaccurate under present conditions. A customer may appeal an allocation established hereunder to the _____ (*designated official or alternatively, a special water allocation review committee*). Industrial customers shall pay the following surcharges:

Customers whose allocation is _____ gallons through _____ gallons per month:

$_____ per thousand gallons for the first 1,000 gallons over allocation.
$_____ per thousand gallons for the second 1,000 gallons over allocation.
$_____ per thousand gallons for the third 1,000 gallons over allocation.
$_____ per thousand gallons for each additional 1,000 gallons over allocation.

Customers whose allocation is _____ gallons per month or more:

_____ times the block rate for each 1,000 gallons in excess of the allocation up through 5 percent above allocation.
_____ times the block rate for each 1,000 gallons from 5 percent through 10 percent above allocation.
_____ times the block rate for each 1,000 gallons from 10 percent through 15 percent above allocation.

_____ times the block rate for each 1,000 gallons more than 15 percent above allocation.

The surcharges shall be cumulative. As used herein, “block rate” means the charge to the customer per 1,000 gallons at the regular water rate schedule at the level of the customer’s allocation.

Section X: Enforcement

(a) No person shall knowingly or intentionally allow the use of water from the _____ (*name of your water supplier*) for residential, commercial, industrial, agricultural, governmental, or any other purpose in a manner contrary to any provision of this Plan, or in an amount in excess of that permitted by the drought response stage in effect at the time pursuant to action taken by _____ (*designated official*), or his/her designee, in accordance with provisions of this Plan.

(b) Any person who violates this Plan is guilty of a misdemeanor and, upon conviction shall be punished by a fine of not less than _____ dollars ($_____) and not more than _____ dollars ($_____). Each day that one or more of the provisions in this Plan is violated shall constitute a separate offense. If a person is convicted of three or more distinct violations of this Plan, the _____ (*designated official*) shall, upon due notice to the customer, be authorized to discontinue water service to the premises where such violations occur. Services discontinued under such circumstances shall be restored only upon payment of a re-connection charge, hereby established at $ _____, and any other costs incurred by the _____ (*name of your water supplier*) in discontinuing service. In addition, suitable assurance must be given to the _____ (*designated official*) that the same action shall not be repeated while the Plan is in effect. Compliance with this plan may also be sought through injunctive relief in the district court.

(c) Any person, including a person classified as a water customer of the _____ (*name of your water supplier*), in apparent control of the property where a violation occurs or originates shall be presumed to be the violator, and proof that the violation occurred on the person’s property shall constitute a rebuttable presumption that the person in apparent control of the property committed the violation, but any such person shall have the right to show that he/she did not commit the violation. Parents shall be presumed to be responsible for violations of their minor children and proof that a violation, committed by a child, occurred on property within the parents’ control shall constitute a rebuttable presumption that the parent committed the violation, but any such parent may be excused if he/she proves that he/she had previously directed the child not to use the water as it was used in violation of this Plan and that the parent could not have reasonably known of the violation.

(d) Any employee of the _____ (*name of your water supplier*), police officer, or other _____ employee designated by the _____ (*designated official*), may issue a citation to a person he/she reasonably believes to be in violation of this Ordinance. The citation shall be prepared in duplicate and shall contain the name and address of the alleged violator, if known, the offense charged, and shall direct him/her to appear in the _____ (*example: municipal court*) on the date shown on the citation for which the date shall not be less than 3 days nor more than 5 days from the date the citation was issued. The alleged violator shall be served a copy of the citation. Service of the citation shall be complete upon delivery of the citation to the alleged violator, to an agent or employee of a violator, or to a person over 14 years of age who is a member of the violator's immediate family or is a resident of the violator's residence. The alleged violator shall appear in _____ (*example: municipal court*) to enter a plea of guilty or not guilty for the violation of this Plan. If the alleged violator fails to appear in _____ (*example: municipal court*), a warrant for his/her arrest may be issued. A summons to appear may be issued in lieu of an arrest warrant. These cases shall be expedited and given preferential setting in _____ (*example: municipal court*) before all other cases.

Section XI: Variances

The _____ (*designated official*), or his/her designee, may, in writing, grant temporary variance for existing water uses otherwise prohibited under this Plan if it is determined that failure to grant such variance would cause an emergency condition adversely affecting the health, sanitation, or fire protection for the public or the person requesting such variance and if one or more of the following conditions are met:

(a) Compliance with this Plan cannot be technically accomplished during the duration of the water supply shortage or other condition for which the Plan is in effect.
(b) Alternative methods can be implemented which will achieve the same level of reduction in water use.

Persons requesting an exemption from the provisions of this Ordinance shall file a petition for variance with the _____ (*name of your water supplier*) within 5 days after the Plan or a particular drought response stage has been invoked. All petitions for variances shall be reviewed by the _____ (*designated official*), or his/her designee, and shall include the following:

(a) Name and address of the petitioner(s).
(b) Purpose of water use.
(c) Specific provision(s) of the Plan from which the petitioner is requesting relief.
(d) Detailed statement as to how the specific provision of the Plan adversely affects the petitioner or what damage or harm will occur to the petitioner or others if petitioner complies with this Ordinance.
(e) Description of the relief requested.
(f) Period of time for which the variance is sought.
(g) Alternative water use restrictions or other measures the petitioner is taking or proposes to take to meet the intent of this Plan and the compliance date.
(h) Other pertinent information.

Far West Texas
Drought Contingency Plan
for a Wholesale Public Water Supplier
(Adapted from TCEQ)

Name:	Click to add text	
Address:		
Telephone Number:	( )	Fax: ( )
Water Right No.(s):		
Regional Water Planning Group:		
Form Completed by:		
Title:		
Person responsible for implementation:		Phone: ( )
Signature:		Date: / /

Section I: Declaration of Policy, Purpose, and Intent

In order to conserve the available water supply and/or to protect the integrity of water supply facilities, with particular regard for domestic water use, sanitation, and fire protection, and to protect and preserve public health, welfare, and safety and minimize the adverse impacts of water supply shortage or other water supply emergency conditions, the _____ (*name of your water supplier*) adopts the following Drought Contingency Plan (the Plan).

Section II: Public Involvement

Opportunity for the public and wholesale water customers to provide input into the preparation of the Plan was provided by _____ (*name of your water supplier*) by means of _____ (*describe methods used to inform the public and wholesale customers about the preparation of the plan and opportunities for input; for example, scheduling and proving public notice of a public meeting to accept input on the Plan*).

Section III: Wholesale Water Customer Education

The _____ (*name of your water supplier*) will periodically provide wholesale water customers with information about the Plan, including information about the conditions under which each stage of the Plan is to be initiated or terminated and the drought response measures to be implemented in each stage. This information will be provided by means of _____ (*example: describe methods to be used to provide customers with information about the Plan; for example, providing a copy of the Plan or periodically including information about the Plan with invoices for water sales*).

Section IV: Coordination with Regional Water Planning Groups

The water service area of the _____ (name of your water supplier) is located within the _____ (*name of regional water planning area or areas*) and the _____ (*name of your water supplier*) has provided a copy of the Plan to the _____ (*name of your regional water planning group or groups*).

Section V: Authorization

The _____ (*designated official; for example, the general manager or executive director*), or his/her designee, is hereby authorized and directed to implement the applicable provisions of this Plan upon determination that such implementation is necessary to protect public health, safety, and welfare. The _____ or his/her designee, shall have the authority to initiate or terminate drought or other water supply emergency response measures as described in this Plan.

Section VI: Application

The provisions of this Plan shall apply to all customers utilizing water provided by the _____ (*name of your water supplier*). The terms "person" and "customer" as used in the Plan include individuals, corporations, partnerships, associations, and all other legal entities.

Section VII: Criteria for Initiation and Termination of Drought Response Stages

The _____ (*designated official*), or his/her designee, shall monitor water supply and/or demand conditions on a (*example: weekly, monthly*) basis and shall determine when conditions warrant initiation or termination of each stage of the Plan. Customer notification of the initiation or termination of drought response stages will be made by mail or telephone. The news media will also be informed.

The triggering criteria described below are based on:
_____.
(*provide a brief description of the rationale for the triggering criteria; for example, triggering criteria are based on a statistical analysis of the vulnerability of the water source under drought of record conditions).*

Utilization of alternative water sources and/or alternative delivery mechanisms:

Alternative water source(s) for _____ (*name of utility*) is/are: _____.
(Examples: Other well(s), Inter-connection with other system, Temporary use of a non-municipal water supply, Purchased water, Use of reclaimed water for non-potable purposes, etc.).

Stage 1 Triggers -- MILD Water Shortage Conditions

Requirements for initiation – The _____ (*name of your water supplier*) will recognize that a mild water shortage condition exists when _____ (*describe triggering criteria, see examples below).*

> ***Below are examples of the types of triggering criteria that might be used in a wholesale water supplier's drought contingency plan.*** *The wholesale water supplier may devise other triggering criteria and an appropriate number of stages tailored to its system; however, the plan must contain a minimum of three drought stages.* ***One or a combination of such criteria may be defined for each drought response stage:***
>
>> ***Example 1: Water in storage in the _____ (name of reservoir) is equal to or less than _____ (acre-feet and/or percentage of storage capacity).***

Example 2: When the combined storage in the _____ (name of reservoirs) is equal to or less than _____ (acre-feet and/or percentage of storage capacity).

Example 3: Flows as measured by the U.S. Geological Survey gage on the _____ (name of river) near _____, Texas reaches _____ cubic feet per second (cfs).

Example 4: When total daily water demand equals or exceeds _____ million gallons for _____ consecutive days or _____ million gallons on a single day.

Example 5: When total daily water demand equals or exceeds _____ percent of the safe operating capacity of _____ million gallons per day for _____ consecutive days or _____ percent on a single day.

Requirements for termination - Stage 1 of the Plan may be rescinded when all of the conditions listed as triggering events have ceased to exist for a period of _____ (*example: 30*) consecutive days. The _____ (*name of water supplier*) will notify its wholesale customers and the media of the termination of Stage 1.

Stage 2 Triggers -- MODERATE Water Shortage Conditions

Requirements for initiation – The _____ (*name of your water supplier*) will recognize that a moderate water shortage condition exists when _____ (*describe triggering criteria*).

Requirements for termination - Stage 2 of the Plan may be rescinded when all of the conditions listed as triggering events have ceased to exist for a period of _____ (*example: 30*) consecutive days. Upon termination of Stage 2, Stage 1, or the applicable drought response stage based on the triggering criteria, becomes operative. The _____ (*name of your water supplier*) will notify its wholesale customers and the media of the termination of Stage 2.

Stage 3 Triggers -- SEVERE Water Shortage Conditions

Requirements for initiation – The _____ (*name of your water supplier*) will recognize that a severe water shortage condition exists when _____ (*describe triggering criteria; see examples in Stage 1*).

Requirements for termination - Stage 3 of the Plan may be rescinded when all of the conditions listed as triggering events have ceased to exist for a period of _____ (*example: 30*) consecutive days. Upon termination of Stage 3, Stage 2, or the applicable drought response stage based on the triggering criteria, becomes operative. The _____ (*name of your water supplier*) will notify its wholesale customers and the media of the termination of Stage 3.

Stage 4 Triggers -- CRITICAL Water Shortage Conditions

Requirements for initiation - The _____ (*name of your water supplier*) will recognize that an emergency water shortage condition exists when _____ (*describe triggering criteria*; *see examples below*).

Example 1. ***Major water line breaks, or pump or system failures occur, which cause unprecedented loss of capability to provide water service; or***

Example 2. ***Natural or man-made contamination of the water supply source(s).***

Requirements for termination - Stage 4 of the Plan may be rescinded when all of the conditions listed as triggering events have ceased to exist for a period of _____ (*example: 30*) consecutive days. The _____ (*name of your water supplier*) will notify its wholesale customers and the media of the termination of Stage 4.

Section VIII: Drought Response Stages

The _____ (*designated official*), or his/her designee, shall monitor water supply and/or demand conditions and, in accordance with the triggering criteria set forth in Section VII, shall determine that mild, moderate, severe, or critical water shortage conditions exist or that an emergency condition exists and shall implement the following actions:

Stage 1 Response -- MILD Water Shortage Conditions

Target: Achieve a voluntary _____ percent reduction in _____ (*example: total water use, daily water demand, etc.*).

Best Management Practices for Supply Management:

Describe additional measures, if any, to be implemented directly by _____ (designated official), or his/her designee(s), to manage limited water supplies and/or reduce water demand. Examples include modifying reservoir operations procedures, interconnection with another water system, and use of reclaimed water for nonpotable purposes.

Water Use Restrictions for Reducing Demand:

(a) The _____ (*designated official*), or his/her designee(s), will contact wholesale water customers to discuss water supply and/or demand conditions and will request that wholesale water customers initiate voluntary measures to reduce water use (*example: implement Stage 1 or appropriate stage of the customer's drought contingency plan*).

(b) The _____ (*designated official*), or his/her designee(s), will provide a weekly report to news media with information regarding current water supply and/or demand conditions, projected water supply and demand conditions if drought conditions persist, and consumer information on water conservation measures and practices.

Stage 2 Response -- MODERATE Water Shortage Conditions

Target: Achieve a _____ percent reduction in _____ (*example: total water use, daily water demand, etc.*).

Best Management Practices for Supply Management:

Describe additional measures, if any, to be implemented directly by _____ (designated official), or his/her designee(s), to manage limited water supplies and/or reduce water demand. Examples include modifying reservoir operations procedures, interconnection with another water system, and use of reclaimed water for non-potable purposes.

Water Use Restrictions for Reducing Demand:

(a) The _____ (*designated official*), or his/her designee(s), will request wholesale water customers to initiate mandatory measures to reduce non-essential water use (*example: implement Stage 2 or appropriate stage of the customer's drought contingency plan*).

(b) The _____ (*designated official*), or his/her designee(s), will initiate weekly contact with wholesale water customers to discuss water supply and/or demand conditions and the possibility of pro rata curtailment of water diversions and/or deliveries.

(c) The _____ (*designated official*), or his/her designee(s), will further prepare for the implementation of pro rata curtailment of water diversions and/or deliveries by preparing a monthly water usage allocation baseline for each wholesale customer.

(d) The _____ (*designated official*), or his/her designee(s), will provide a weekly report to news media with information regarding current water supply and/or demand conditions, projected water supply and demand conditions if drought conditions persist, and consumer information on water conservation measures and practices.

Stage 3 Response -- SEVERE Water Shortage Conditions

Target: Achieve a _____ percent reduction in _____ (*example: total water use, daily water demand, etc.*).

Best Management Practices for Supply Management:

Describe additional measures, if any, to be implemented directly by _____ (designated official), or his/her designee(s), to manage limited water supplies and/or reduce water demand. Examples include modifying reservoir operations procedures, interconnection with another water system, and use of reclaimed water for non-potable purposes.

Water Use Restrictions for Reducing Demand:

(a) The _____ (*designated official*), or his/her designee(s), will contact wholesale water customers to discuss water supply and/or demand conditions and will request that wholesale water customers initiate additional mandatory measures to reduce non-essential water use (example: implement Stage 3 or appropriate stage of the customer's drought contingency plan).

(b) The _____ (*designated official*), or his/her designee(s), will initiate pro rata curtailment of water diversions and/or deliveries for each wholesale customer.

(c) The _____ (*designated official*), or his/her designee(s), will provide a weekly report to news media with information regarding current water supply and/or demand conditions, projected water supply and demand conditions if drought conditions persist, and consumer information on water conservation measures and practices.

Stage 4 Response -- EMERGENCY Water Shortage Conditions

Whenever emergency water shortage conditions exist as defined in Section VII of the Plan, the _____ (*designated official*) shall:

1. Assess the severity of the problem and identify the actions needed and time required to solve the problem.
2. Inform the utility director or other responsible official of each wholesale water customer by telephone or in person and suggest actions, as appropriate, to alleviate problems (*example: notification of the public to reduce water use until service is restored*).

3. If appropriate, notify city, county, and/or state emergency response officials for assistance.
4. Undertake necessary actions, including repairs and/or clean-up as needed.
5. Prepare a post-event assessment report on the incident and critique of emergency response procedures and actions.

Section IX: Pro Rata Curtailment

In the event that the triggering criteria specified in Section VII of the Plan for Stage 3 – Severe Water Shortage Conditions have been met, the _____ (*designated official*) is hereby authorized to initiate allocation of water supplies on a pro rata basis in accordance with Texas Water Code, §11.039.

Section X: Contract Provisions

The _____ (*name of your water supplier*) will include a provision in every wholesale water contract entered into or renewed after adoption of the plan, including contract extensions, that in case of a shortage of water resulting from drought, the water to be distributed shall be divided in accordance with Texas Water Code, §11.039.

Section XI: Enforcement

During any period when pro rata allocation of available water supplies is in effect, wholesale customers shall pay the following surcharges on excess water diversions and/or deliveries:

Example of surcharge:

_____ times the normal water charge per acre-foot for water diversions and/or deliveries in excess of the monthly allocation from _____ percent through _____ percent above the monthly allocation.

Section XII: Variances

The _____ (*designated official*), or his/her designee, may, in writing, grant a temporary variance to the pro rata water allocation policies provided by this Plan if it is determined that failure to grant such variance would cause an emergency condition adversely affecting the public health, welfare, or safety and if one or more of the following conditions are met:

(a) Compliance with this Plan cannot be technically accomplished during the duration of the water supply shortage or other condition for which the Plan is in effect.
(b) Alternative methods can be implemented which will achieve the same level of reduction in water use.

Persons requesting an exemption from the provisions of this Plan shall file a petition for variance with the _____ (*designated official*) within 5 days after pro rata allocation has been invoked. All petitions for variances shall be reviewed by the _____ (*governing body*), and shall include the following:

(a) Name and address of the petitioner(s).
(b) Detailed statement with supporting data and information as to how the pro rata allocation of water under the policies and procedures established in the Plan adversely affects the petitioner or what damage or harm will occur to the petitioner or others if petitioner complies with this Ordinance.
(c) Description of the relief requested.
(d) Period of time for which the variance is sought.
(e) Alternative measures the petitioner is taking or proposes to take to meet the intent of this Plan and the compliance date.

(f) Other pertinent information.

Variances granted by the _____ (*governing body*) shall be subject to the following conditions, unless waived or modified by the _____ (*governing body*) or its designee:

(a) Variances granted shall include a timetable for compliance.
(b) Variances granted shall expire when the Plan is no longer in effect, unless the petitioner has failed to meet specified requirements.

No variance shall be retroactive or otherwise justify any violation of this Plan occurring prior to the issuance of the variance.

Section XIII: Severability

It is hereby declared to be the intention of the _____ (*governing body of your water supplier*) that the sections, paragraphs, sentences, clauses, and phrases of this Plan are severable and, if any phrase, clause, sentence, paragraph, or section of this Plan shall be declared unconstitutional by the valid judgment or decree of any court of competent jurisdiction, such unconstitutionality shall not affect any of the remaining phrases, clauses, sentences, paragraphs, and sections of this Plan, since the same would not have been enacted by the _____ (*governing body of your water supplier*) without the incorporation into this Plan of any such unconstitutional phrase, clause, sentence, paragraph, or section.

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CHAPTER 8

POLICY RECOMMENDATIONS AND UNIQUE SITES

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8 POLICY RECOMMENDATIONS AND UNIQUE SITES

An important aspect of the regional water planning process is the opportunity for the Far West Texas Water Planning Group (FWTWPG) to discuss water policy issues that are important to this Region and provide recommendations for the improvement of future water management planning in Texas. The recommendations are designed to present new and/or modified approaches to key technical, administrative, institutional, and policy matters that will help to streamline the planning process, and to offer guidance to future planners regarding specific issues of concern within the Region. This chapter also addresses recommendations of “Ecologically Unique River and Stream Segments” and consideration of “Unique Sites for Reservoir Construction”. The FWTWPG approves of the legislative intent of the regional water planning process and supports the continuance of water planning at the regional level.

8.1 WATER MANAGEMENT POLICY

1. **Stormwater / Flood Planning**. In 2019, voters approved a constitutional amendment providing for the creation of the Flood Infrastructure Fund to assist in the financing of drainage, flood mitigation, and flood control projects. The FWTWPG fully supports this new initiative and suggest that, in time, the program will grow to encompass projects that encourage retained stormwater as a vital new water-supply resource. Such planning is recognized in this *2021 Far West Texas Water Plan* as a recommended water management strategy. Effective stormwater planning will be beneficial to regional water resources including aquifer recharge and optimization of surface water resources. The FWTWPG looks forward to coordinating with the State's Regional Flood Planning groups (http://www.twdb.texas.gov/flood/index.asp#recentnews).

2. **Needed Funding for Data Collection in Rural Areas**. Rural areas need to be able to access State funding to gather the information needed to draft a substantive regional plan. This funding is needed for test wells, monitoring equipment, observation wells, modeling, and to obtain more data on the West Texas aquifers. The FWTWPG should be allowed to request additional funding for the data needs and contract for the studies.

3. **Colonias**. Far West Texas contains a significant portion of the colonias in the State of Texas. While much effort has gone into rectifying the substandard water and wastewater conditions in the region (see Section 1.10 in Chapter 1 of this *Plan*), many of these economically distressed neighborhoods continue to exist. The FWTWPG encourages State and Federal agencies to continue their financial programs so that all citizens, regardless of their social and economic status, can be provided with a safe and healthy living environment. The FWTWPG is specifically appreciative of the reestablishment of the TWDB Economically Distressed Area Program (EDAP) and encourages the legislature to properly fund this vital program.

4. **Rio Grande Interstate Litigation**. The FWTWPG recognizes the potential impact of diminished water-supply availability from the Rio Grande resulting from excess diversion of Rio Grande surface water and the hydrologically connected underground water downstream of Elephant Butte Reservoir that is intended for use within the Rio Grande Project. The FWTWPG considers this action contrary to the purpose and intent of the Rio Grande Compact and encourages the State of Texas to continue its pursuit of rectifying the action through whatever action is deemed most appropriate.

5. **Regionalization.** Participants (municipal utilities) in the FWTWPG continue to maintain a robust regional relationship by helping unserved or underserved water systems become sustainable and resilient. Funding policies may impede this effort by suggesting regionalization through consolidation of water districts. The FWPWPG finds that entities in unserved or underserved areas should still be eligible for financial assistance. The grant or loan eligibility for unserved or underserved service area should be treated independently from the provider of some services through interlocal agreements.

   The FWTWPG finds that many unserved or underserved rural areas lack technical, financial, managerial, or funding to operate some field or administrative aspect required by funding agencies to maintain or provide safe affordable water or wastewater services in a sustainable manner. However, water utilities contiguous to the local utilities have the capacity to assist as many do through interlocal agreements between the utilities. The FWTWPG promotes these efforts and finds that funding mechanisms should account for regionalized relationships other than consolidation when considering funding for projects. The utilities by virtue of interlocal agreements may be able to satisfy eligibility requirements regarding experience, capacity, and sustainability, which demonstrate the capacity to provide essential and sustainable water and sewer service to the areas in need.

8.2 REGIONAL WATER PLANNING PROCESS

1. **Re-emphasis of the Planning Function of the Regional Water Planning Group and Need for More Local Planning Initiatives**. The planning process increasingly focuses too heavily on meeting the technical requirements of the regional water planning process and the TAC rules, to the detriment of allowing for local planning initiatives. The role of the Regional Water Planning Group no longer seems to include "planning"; rather, it meets primarily to ratify deadlines and requirements of the TWDB. Certainly, this seems to contradict the goal of Senate Bill 1. Providing for more local influence of the process and reducing the numerous, standardized checklists of the requirements of the Plan would help. The planning process and the ultimate Plan must be flexible because of the unique characteristics of the border region. The FWTWPG should have the legal ability to consider all water resources available to the Region, regardless of whether or not they are located within Texas.

2. **Elimination of Unfunded Mandate**. The current regulations of the TWDB require local entities to pay for 100 percent of the administrative costs of developing the plans. This is difficult to sell when a local government has to tell its constituents that they have to do with one less full-time deputy, a lower level of funding for the library, and no new fire truck – but that they can afford to pay for a water plan. Trying to force local "buy-in" by requiring local funding causes resentment of the process and antagonism toward the plan. The State should pay for what the State thinks is important. The current 100/100 Plan is an improvement over the original concept (pursuant to which the State was to pay for 75 percent of everything, including administration), but it is still an unfunded mandate, and is still a bad idea – no matter how good the idea being funded.

3. **Modification of Demand Numbers**. Modification of demand numbers should be allowed further into the planning process. Demand errors may not be discovered until the supply-demand analysis is performed. The manner in which the irrigation and livestock demand numbers increase during drought scenarios is inappropriate because other factors influence the demand. For example, during a drought in Far West Texas, livestock are sold, thus reducing the overall demand on groundwater. There needs to be a better understanding of the process of how livestock, drought and water demand interact, and this understanding needs to be reflected in the demand numbers.

4. **El Paso County Irrigation Demand Projection.** Chapter 2 of this *Plan* includes a value of 149,570 acre-feet per year as estimated irrigation water demand for El Paso County, but the value is based on historical water use during an extreme drought. A more accurate estimate is the one included in the Water Demand Projection in Table 2-2 of the 2016 Far West Texas Water Plan, showing estimated irrigation water demand of 242,798 acre-feet per year based on years with an adequate supply of surface water. The latter value is more accurate than the former value because the methodology used by TWDB, as documented in the February 2017 TWDB Water Demand Project Methodologies report, uses average irrigation water use over the most recent five years (2010-2014), instead of during a period of adequate surface water supply, as the basis for estimating future surface water irrigation demands in El Paso and Hudspeth Counties.

5. **Plan Implementation**. Implementation of the plan's recommendations must be the responsibility of the local governments, entities, and individuals within the region. The Water Planning Group is not intended to assume a supervisory or command-and-control role. The Water Planning

Group's function will be to monitor implementation and assist the local governments, entities, and individuals within the region as requested.

6. **State Mandated Water Planning**. State mandated water planning for this region began in 1999. The water plan to be completed in 2021 will be the fifth round of planning. The details of water planning in this region are not changing dramatically over five-year periods. Funding is needed for the implementation of the water supply projects presented in the Water Plan.

7. **Contractual Guidelines.** Contractual guidelines for the performance of regional water planning should be established at the beginning of each 5-year planning period, and not modified, especially without added funding, during that planning period. Inter-period modifications result in unscheduled distractions, time and expense, in performing the required planning procedures in which the contracts are based. Legislative modifications thus should only be implemented at the beginning of the existing planning period.

8. **Task 5A Requirement.** The Task 5A requirement to develop a scope of work and budget allotment for water management strategy evaluation is unfunded, time consuming, and does not result in better plan development. It is recognized that the requirement is intended to ensure that budget allotments are justifiably spent; however, there is no obvious improvement to the planning process.

8.3 WATER RESEARCH NEEDS

- There is a concern that some historical irrigation pumpage reported by the TWDB is inaccurate. The TWDB should continue its irrigation surveys and attempt to improve the estimates with the assistance of local irrigation and groundwater districts.
- A study should be performed to evaluate the feasibility and potential benefits of rechanneling a segment of the Rio Grande below Fort Quitman.
- A significant amount of groundwater is produced from Cretaceous limestone formations in southern Brewster County that exist outside the boundary of the Edwards-Trinity (Plateau) Aquifer. The communities of Lajitas, Terlingua, and Study Butte, along with other rural users rely on this sole source of water to meet their daily needs. An aquifer characterization study is needed to estimate its vertical and lateral extent, sustainable yield, and water quality.
- Provide funding for the development of the Transboundary Aquifer Model of the Mesilla Bolson. Ciudad Juarez has built the infrastructure needed to capture groundwater from the Conejos Medanos Aquifer, which is the southern extension of the Mesilla Bolson. Development of this regional model will allow water quantity and quality impacts to be evaluated.
- An Integrated Rio Grande Data Management System allowing for regional coordination of the Rio Grande for better management and decision making of irrigation releases and flood control is needed. Also, the Rio Grande Project delivery system is in need of a real-time water quantity and water quality monitoring system so that agriculture, municipal and regulatory agencies can better manage and account for the water. The benefits would improve efficiency, flood control management and warnings of contaminant releases. Thus, information systems analysis and hydrologic operations modeling are recommended.
- Provide research funding for the Rio Grande Salinity Management Coalition (RGSMC). The goal of the coalition is to ultimately reduce salinity concentrations in the Rio Grande, which will allow increased beneficial use of the water for agriculture, urban and environmental purposes.

8.4 ECOLOGICALLY UNIQUE RIVER AND STREAM SEGMENTS

As a part of the planning process, each regional planning group may include recommendations for the designation of Ecologically Unique River and Stream Segments in their adopted regional water plan (31 TAC 357.8). The Texas Legislature may designate a river or stream segment of unique ecological value following the recommendations of a regional water planning group. As per §16.051(f) of the Texas Water Code, this designation solely means that a state agency or political subdivision of the State may not finance the actual construction of a reservoir in a specific river or stream segment designated by the legislature under this subsection.

Stream segment designation is to be supported by a recommendation package that includes a physical description, maps, photographs, literature citations, and data pertaining to each candidate stream segment. In accordance with the TWDB's rules, the following criteria are to be used when recommending a river or stream segment as being of unique ecological value:

- **Biological Function –** Segments which display significant overall habitat value including both quantity and quality considering the degree of biodiversity, age, and uniqueness observed and including terrestrial, wetland, aquatic, or estuarine habitats;
- **Hydrologic Function –** Segments which are fringed by habitats that perform valuable hydrologic functions relating to water quality, flood attenuation, flow stabilization, or groundwater recharge and discharge;
- **Riparian Conservation Areas –** Segments which are fringed by significant areas in public ownership including state and federal refuges, wildlife management areas, preserves, parks, mitigation areas, or other areas held by governmental organizations for conservation purposes under a governmentally approved conservation plan;
- **High Water Quality/Exceptional Aquatic Life/High Aesthetic Value –** Segments and spring resources that are significant due to unique or critical habitats and exceptional aquatic life uses dependent on or associated with high water quality; or
- **Threatened or Endangered Species/Unique Communities –** Sites along segments where water development projects would have significant detrimental effects on state or federally listed threatened and endangered species, and sites along segments that are significant due to the presence of unique, exemplary, or unusually extensive natural communities.

A quantitative assessment of how recommended water management strategies (Chapter 5) potentially could affect flows deemed important by the FWTWPG to the Ecologically Unique River and Stream Segments (EURSS) was performed by considering the following criteria:

- Distance from the strategy supply source to the EURSS
- Does the strategy groundwater supply source (aquifer) contribute flow to the EURSS
- Does the strategy surface water supply source (Rio Grande) contribute flow to the EURSS
- Percent diminished flow to the EURSS resulting from implementation of the strategy

The FWTWPG chooses to respect the privacy of private landowners and therefore recommends only parts of river and stream segments that are within the management boundaries of State and National Parks, and conservation lands managed by the Texas Nature Conservancy and Trans Pecos Water Trust at their request. Notification was given to the public that the FWTWPG would consider river and stream segments on private property only if requested by the landowner.

In previous planning periods, the FWTWPG has recommended three streams that lie within the boundaries of state-managed properties, four within National Park boundaries, and specified streams managed by the Texas Nature Conservancy and Texas Pecos Land Trust as listed below (Figure 8-1). All segments are recommended by the TWDB in the 2017 State Water Plan, and all recommended segments except the Alamito Creek (Texas Pecos Land Trust) and Terlingua Creek (Big Bend National Park) have been designated by the Texas Legislature. Recommendation packages for these two remaining segments were included in the *2011 (Alamito Creek – Appendix 8F) and 2016 (Terlingua Creek – Appendix 8A) Far West Texas Water Plans*, and their continued recommended status is consistent with this *2021 Plan*. Appendix 8A of this *Plan* provides the TPWD response to the continued recommendation of Alamito and Terlingua Creeks as Ecologically Unique Stream Segments in Far West Texas.

- **Rio Grande Wild and Scenic River (Big Bend National Park)** primarily depends on flows from the Rio Conchos and from springs and spring-fed tributaries along the Big Bend stretch of the River. No strategies occur in the aquifers that feed the springs and tributaries. Historically, the Upper Rio Grande (El Paso and Hudspeth Counties) flowed almost unabated through the Far West Texas stretch of the River. However, with today's upstream water demands on the River, only a minor flow from the Upper Rio Grande segment manages to periodically contribute to the Lower Rio Grande segment (Presidio, Brewster and Terrell Counties). Strategies presented in this plan do not significantly reduce this downstream contribution.
- **Terlingua Creek (Big Bend National Park)** flows six miles within Big Bend National Park to its confluence with the Rio Grande immediately downstream of Santa Elena Canyon, an area of exceptional aesthetic value. The National Park Service has declared Terlingua Creek to have exceptional aesthetic value. The Proserpine shiner is a desert fish with a limited geographic range and is threatened primarily by decreased spring flows, habitat loss and alteration of flow regimes. The species only occurs in Texas and was designated as critically threatened by TPWD in 1977. Terlingua Creek is within the natural habitat of this species.
- **McKittrick Canyon and Chosa Creek (Guadalupe Mountains National Park)** are spring fed at high elevations of the Capitan Reef Aquifer within the Park. Potential groundwater pumped and transported from the Diablo Farms section of the Capitan Reef Aquifer (Strategy E-16) is separated from the spring sources by distance, faulting and elevation. Also, pumping and transport of groundwater from the Bone Spring – Victorio Peak Aquifer in the Dell City area (Strategy E-17) is also separated from the spring sources by distance, faulting and elevation. Thus, pumping from these aquifers should have no impact on aquifer sources that contribute to springflow.
- **Cienega Creek (Chinati Mountains State Natural Area)** is spring fed from high elevation exposures of the Davis Mountains Igneous Aquifer. Only strategy E-59 in Fort Davis considers a pumping project in the Igneous Aquifer. However, the pumping location is distant from this designated stream and thus will have no water flow impact.
- **Alamito and Cienega Creeks (Big Bend Ranch State Park)** are spring fed from high elevation exposures of the Davis Mountains Igneous Aquifer. Only strategy E-59 in Fort Davis considers a

pumping project in the Igneous Aquifer. However, the pumping location is distant from this designated stream and thus will have no water flow impact.

- **Alamito Creek (Trans Pecos Water Trust)** is spring fed from high elevation exposures of the Davis Mountains Igneous Aquifer. Only strategy E-59 in Fort Davis considers a pumping project in the Igneous Aquifer. However, the pumping location is distant from this designated stream and thus will have no water flow impact.
- **Independence Creek (Texas Nature Conservancy – Independence Creek Preserve)** is spring fed from the Edwards-Trinity (Plateau) Aquifer. Only one strategy (E-65 Terrell County Mining) considers additional well pumping from the Edwards-Trinity (Plateau) Aquifer. However, this pumping is distant from this designated stream segment and thus will have no water flow impact.
- **Madera Creek, Canyon Headwaters of Limpia Creek, Little Aguja Creek, and Upper Cherry Creek (Texas Nature Conservancy – Davis Mountains Preserve)** are spring fed from high elevation exposures of the Davis Mountains Igneous Aquifer. Only strategy E-59 in Fort Davis considers a pumping project in the Igneous Aquifer. However, the pumping location is distant from this designated stream and thus will have no water flow impact.

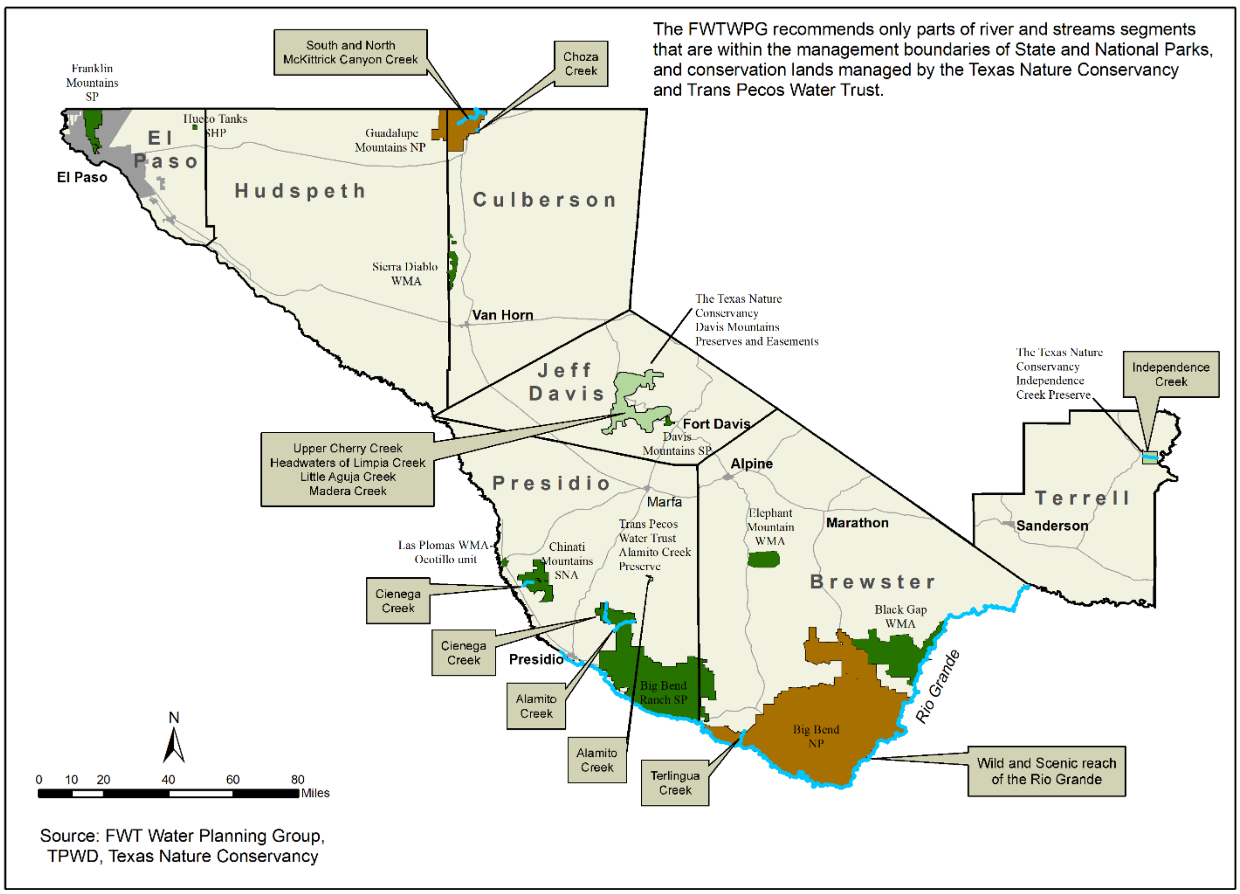

Figure 8-1. Recommended Ecologically Unique River and Stream Segments

8.5 CONSIDERATION OF UNIQUE SITES FOR RESERVOIR CONSTRUCTION

The regional water planning process gives each of the 16 regional water planning groups the opportunity to recommend stream locations for designation as “Unique Sites for Reservoir Construction". The regional water planning process legislation and rules list many criteria to determine if a site is qualified for such designation.

The availability of water is one of the most important criteria in the selection of a reservoir site - if not the most important criterion. The low rainfall totals and the spotty nature of precipitation in Far West Texas limit the potential for sufficient runoff to maintain desired water levels in reservoirs.

Many canyons in the mountainous areas of Far West Texas might not retain large volumes of water because of the fractured and often highly permeable bedrock that forms the walls and floors of these topographic features. Any attempt to develop a reservoir in Far West Texas will require extensive and costly geological, geotechnical, and hydrological investigations to determine whether a site is suitable. The program of work would also require detailed state and federal environmental impact assessments. With regard to the Rio Grande, the 1944 International Treaty between the United States and Mexico specifies that a reservoir project considered by one country have the other country’s permission. Furthermore, the treaty stipulates that international reservoirs are to be operated by both countries.

On watercourses other than the Rio Grande, the water use reported to the TCEQ by surface water right holders gives some clues as to which watercourses are the most reliably used and therefore could be investigated for potential reservoir sites. Reported water use data, provided by the Rio Grande Watermaster and by TCEQ, have been examined to identify holders of surface water rights who can divert water in amounts greater than 1,000 acre-feet per year. The analysis indicates that Musquiz and Maravillas Creeks in Brewster County are probably the most reliable surface water sources.

On Alamito Creek in Presidio County, there is an existing recreational reservoir authorized to impound 18,700 acre-feet, but diversions are not authorized and therefore no use amounts are reported. Whether this reservoir stays reliably full is unknown, and the reliability of Alamito Creek in general is unknown.

A feasibility study for a recreational lake site near Alpine was previously conducted and consideration was given to its municipal water supply potential. The project was abandoned because of its high cost-to-yield potential.

Additional off-channel reservoir sites, as well as flood protection dam sites on major arroyos have been studied by the Hudspeth County Conservation and Reclamation District #1, El Paso-Hudspeth County Soil Conservation District, and the Hudspeth County Commissioners Court. None of these sites have been selected for construction. Additional flood retention dams have been considered for the El Paso area. These retention dams would have the added benefit of increasing recharge of the local aquifer by increasing infiltration of the retained water into the bolson deposits.

The firm yield for any reservoirs constructed on even the most reliable Far West Texas watercourses is not likely to exceed 2,000 acre-feet per year. For this reason, the *2021 Far West Texas Water Plan* does not recommend any watercourse for designation as “Unique Sites for Reservoir Construction.”

APPENDIX 8A

TPWD RESPONSE TO UNIQUE STREAM SEGMENT RECOMMENDATION

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October 27, 2020

John Ashworth
Far West Texas Water Planning Group Consultant
LBG-Guyton Associates
1101 Capital of Texas Highway
Suite B-220
Austin, Texas 78746

Dear Mr. Ashworth,

Thank you for forwarding the Far West Texas Regional Water Planning Group's nomination package for the segment of Alamito Creek in Presidio County owned by the Trans Pecos Water Trust and the segment of Terlingua Creek within the boundaries of Big Bend National Park in Brewster County. As per the Texas Administrative Code (TAC), TPWD staff has reviewed the package and offers the following comments.

TPWD staff agree that the segment of Alamito Creek in Presidio County owned by the Trans Pecos Water Trust and the segment of Terlingua Creek within the boundaries of Big Bend National Park in Brewster County meet one or more of the ecologically significant criteria set out in TAC Chapter 357.43: 1) biological function, 2) hydrologic function, 3) riparian conservation area, 4) high water quality/exceptional or high aquatic life use/high aesthetic value and, 5) presence of threatened or endangered species or unique communities. The recommendation package for Terlingua Creek includes required descriptions, documentation and citations to support the selection of this segment. The recommendation package for Alamito Creek includes the required description and a map but not citations. However, the nomination package did include TPWD's March 2016 letter (attached) describing species of greatest conservation need found there.

Alamito Creek downstream of the FM 169 crossing to the confluence with the Rio Grande is included in TPWD's list of ecologically significant stream segments (http://tpwd.texas.gov/landwater/water/conservation/water_resources/water_quantity/sigsegs/regione.phtml). Alamito Creek exhibits high water quality, exceptional aquatic life and high aesthetic value, and diverse benthic macroinvertebrate and fish communities. The creek provides habitat for the state threatened Mexican Stoneroller and historically supported a population of the Conchos Pupfish, also a state threatened species, but it has not been collected from the creek recently. In addition, the portion of Alamito Creek owned by the Trans Pecos Water Trust contains Mixed Hardwood-Cottonwood Gallery that provides suitable habitat for numerous Chihuahuan desert riparian species of greatest conservation need (SGCN) including Black bear, Common Black-Hawk, Gray Hawk, Zone-tailed Hawk, Yellow-billed cuckoo, Summer Tanager, Painted Bunting, and Chihuahuan mudturtle. Species of greatest conservation need include species that are declining or rare and in need of attention to recover or to prevent the need to list under state or federal regulation. TPWD staff believe the segment of Alamito Creek upstream of the FM 169 crossing also meets the criteria for high water quality and presence of threatened or endangered species or unique ecological communities.

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AUSTIN, TEXAS 78744-3291
512.389.4800

www.tpwd.texas.gov

The segment of Terlingua Creek within the boundaries of Big Bend National Park in Brewster County is also included in TPWD's list of ecologically significant stream segments. This segment meets criteria for Riparian conservation area, High water quality/exceptional aquatic life/high aesthetic value and threatened or endangered species/unique communities. Terlingua Creek supports a unique fish community composed SGCN species including listed species. Please note TPWD's information to support the unique community criteria for this segment of Terlingua Creek is being updated to read:

Threatened or endangered species/unique communities: The fish community of Terlingua Creek includes the following fish species: Chihuahua shiner (SGCN/St.T), Tamaulipas shiner (SGCN/St.T), Speckled chub (SGCN/St.T), Longnose dace (SGCN) and Rio Grande silvery minnow (St. E., Fed. E.). Terlingua Creek historically supported a population of the Conchos pupfish (St. T), but none have been collected recently.

TPWD appreciates the opportunity to review the information provided recommending designation by the Legislature as ecologically unique the two stream segments located on Alamito Creek and Terlingua Creek. TPWD also appreciates the Far West Regional Water Planning Group's earlier efforts that have successfully led to designation of Ecologically Unique Streams within the planning region.

Please do not hesitate to contact me if you have any questions. I can be reached at 512/389-7015 or cindy.loeffler@tpwd.texas.gov.

Sincerely,

Cindy Loeffler

Cindy Loeffler, Chief
Water Resources Branch

Enclosures: 1

CHAPTER 9

WATER INFRASTRUCTURE FINANCING ANALYSIS

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9 WATER INFRASTRUCTURE FINANCING ANALYSIS

The Infrastructure Financing Report (IFR) survey presented in this chapter identifies the state financing options proposed by entities in this *Plan* to meet future infrastructure needs. Chapter 5 provides recommended water management strategies for numerous communities in Far West Texas that either have a projected water supply deficit and recommended strategies to meet that need or have an identified need for a water supply infrastructure project, which may require state financial assistance. These entities were surveyed to determine their proposed method(s) for financing the estimated capital costs involved in implementing the water supply strategies recommended in the *2021 Far West Texas Water Plan*.

Unlike infrastructure financing surveys conducted for previous regional water plans, questions during this planning cycle focused on projected needs for financial assistance from programs administered by the TWDB. The TWDB will aggregate the projected requests for funding from these programs from the 16 water planning regions to provide a picture of estimated long-term infrastructure funding needs to the State Legislature.

9.1 TWDB FUNDING PROGRAMS

The TWDB offers financial assistance for the planning, design and construction of projects identified in Regional Water Plans or the State Water Plan. Programs available include the State Water Implementation Fund for Texas (SWIFT), Water Infrastructure Fund (WIF), the State Participation Fund (SP), and the Economically Distressed Areas Program (EDAP). To be eligible to apply for funding from the SWIFT source, the applicant must be a political subdivision of the state, or in some cases a water supply corporation and the proposed project must be a recommended water management strategy in the most recent approved Regional Water Plan or State Water Plan.

9.1.1 State Water Implementation Fund for Texas (SWIFT)

The Texas Legislature created the SWIFT to provide affordable, ongoing state financial assistance for projects in the state water plan. Passed by the Legislature and approved by Texas voters through a constitutional amendment, the SWIFT helps communities develop and optimize water supplies at cost-effective rates. The program provides low-interest loans, extended repayment terms, deferral of loan repayments, and incremental repurchase terms for projects with state ownership aspects. Recognizing the benefit of conservation and the needs of rural Texas, the legislation directed that not less than 10% of the SWIFT funding should support projects for rural communities and agricultural water conservation; and not less than 20% of the funds should support water conservation and reuse projects.

9.1.2 Water Infrastructure Fund (WIF)

The Water Infrastructure Fund (WIF) provides subsidized interest rate loans for planning, design and construction. The WIF-Deferred fund offers the option of deferring all interest and principal payments for up to 10 years for planning, design and permitting costs, while the WIF-Construction fund offers subsidized interest for all construction costs including planning, acquisition, design, and construction.

9.1.3 State Participation Fund (SP)

The State Participation Fund (SP) is geared towards large projects which are regional in scope and meant to capitalize on economies of scale in design and construction, but where the local project sponsors are unable to assume the debt for an optimally sized facility. The TWDB assumes a temporary ownership interest in the project, and the local sponsor repays the cost of the funding through purchase payments on a deferred schedule. The goal of the program is to build a project that will be the right size for future needs, even if that results in the short term in building excess capacity, rather than constructing one or more smaller projects now.

9.1.4 Rural and Economically Distressed Areas (EDAP)

Both grants and zero percent interest loans for planning, design and construction costs are offered through these programs, which are available to eligible small, low-income communities. Rural and economically distressed areas that meet population, income and other criteria are eligible to apply for these funds. EDAP funding eligibility also requires adoption of the Texas Model Subdivision Rules by the applicant planning entities.

9.2 INFRASTRUCTURE FINANCE SURVEY

The survey instrument is prefaced with an explanation of its purpose in identifying the need for financial assistance programs offered by the State of Texas and administered by the TWDB. The available funding programs (SWIFT, WIF, SP and EDAP) are summarized, and the survey participant is asked to: 1) identify the amounts they might request from each funding source for each identified project or strategy; and 2) the earliest date the funds would be needed, by fund type. Water user groups with multiple strategies to meet future water needs are only surveyed for strategies with a capital cost.

All communities listed in Chapter 5 water management strategies were presented with surveys provided by the TWDB. The survey along with supporting documentation that summarized the water management strategies included in the *Regional Plan* for that entity were delivered to the mayor or the city/utility manager and follow-up contacts were made with each entity to encourage response to the survey. Table 9-1 presents the surveys responses.

Table 9-1. Infrastructure Finance Survey

Sponsor Entity Name	Project Name	IFR Element Name	IFR Element Value	Year of Need
EAST MONTANA WATER SYSTEM	EAST MONTANA WS - WATER LOSS AUDIT AND MAIN-LINE REPAIR	PLANNING, DESIGN, PERMITTING & ACQUISITION FUNDING	$1,124,435	2021
EAST MONTANA WATER SYSTEM	EAST MONTANA WS - WATER LOSS AUDIT AND MAIN-LINE REPAIR	CONSTRUCTION FUNDING	$6,488,627	2022
EAST MONTANA WATER SYSTEM	EAST MONTANA WS - WATER LOSS AUDIT AND MAIN-LINE REPAIR	PERCENT STATE PARTICIPATION IN OWNING EXCESS CAPACITY	$0	
EL PASO COUNTY TORNILLO WID	EL PASO CO. TORNILLO WID - ADDITIONAL GROUNDWATER WELL AND TRANSMISSION LINE	PLANNING, DESIGN, PERMITTING & ACQUISITION FUNDING		Project completed
EL PASO COUNTY TORNILLO WID	EL PASO CO. TORNILLO WID - ADDITIONAL GROUNDWATER WELL AND TRANSMISSION LINE	CONSTRUCTION FUNDING		
EL PASO COUNTY TORNILLO WID	EL PASO CO. TORNILLO WID - ADDITIONAL GROUNDWATER WELL AND TRANSMISSION LINE	PERCENT STATE PARTICIPATION IN OWNING EXCESS CAPACITY		
FORT DAVIS WSC	FORT DAVIS WSC - ADDITIONAL GROUNDWATER WELL	PLANNING, DESIGN, PERMITTING & ACQUISITION FUNDING		Project completed
FORT DAVIS WSC	FORT DAVIS WSC - ADDITIONAL GROUNDWATER WELL	CONSTRUCTION FUNDING		
FORT DAVIS WSC	FORT DAVIS WSC - ADDITIONAL GROUNDWATER WELL	PERCENT STATE PARTICIPATION IN OWNING EXCESS CAPACITY		
FORT DAVIS WSC	FORT DAVIS WSC - ADDITIONAL TRANSMISSION LINE	PLANNING, DESIGN, PERMITTING & ACQUISITION FUNDING		Project no longer planned
FORT DAVIS WSC	FORT DAVIS WSC - ADDITIONAL TRANSMISSION LINE	CONSTRUCTION FUNDING		
FORT DAVIS WSC	FORT DAVIS WSC - ADDITIONAL TRANSMISSION LINE	PERCENT STATE PARTICIPATION IN OWNING EXCESS CAPACITY		
HACIENDAS DEL NORTE WID	HACIENDAS DEL NORTE WID - WATER LOSS AUDIT AND MAIN-LINE REPAIR	PLANNING, DESIGN, PERMITTING & ACQUISITION FUNDING	$250,000	2022
HACIENDAS DEL NORTE WID	HACIENDAS DEL NORTE WID - WATER LOSS AUDIT AND MAIN-LINE REPAIR	CONSTRUCTION FUNDING	$750,000	2023

Table 9-1. (continued) Infrastructure Finance Survey

ponsor Entity Name	Project Name	IFR Element Name	IFR Element Value	Year of Need
HACIENDAS DEL NORTE WID	HACIENDAS DEL NORTE WID - WATER LOSS AUDIT AND MAIN-LINE REPAIR	PERCENT STATE PARTICIPATION IN OWNING EXCESS CAPACITY	$0	
IRRIGATION, EL PASO	EL PASO COUNTY - EPCWID #1 - IMPROVEMENTS TO WATER DISTRICT DELIVERY SYSTEM	PLANNING, DESIGN, PERMITTING & ACQUISITION FUNDING	$500,000	2021
IRRIGATION, EL PASO	EL PASO COUNTY - EPCWID #1 - IMPROVEMENTS TO WATER DISTRICT DELIVERY SYSTEM	CONSTRUCTION FUNDING	$5,500,000	2021
IRRIGATION, EL PASO	EL PASO COUNTY - EPCWID #1 - IMPROVEMENTS TO WATER DISTRICT DELIVERY SYSTEM	PERCENT STATE PARTICIPATION IN OWNING EXCESS CAPACITY	$0	
IRRIGATION, EL PASO	EL PASO COUNTY - EPCWID #1 - IRRIGATION SCHEDULING	PLANNING, DESIGN, PERMITTING & ACQUISITION FUNDING	$0	NA
IRRIGATION, EL PASO	EL PASO COUNTY - EPCWID #1 - IRRIGATION SCHEDULING	CONSTRUCTION FUNDING	$102,595	2025
IRRIGATION, EL PASO	EL PASO COUNTY - EPCWID #1 - IRRIGATION SCHEDULING	PERCENT STATE PARTICIPATION IN OWNING EXCESS CAPACITY	$0	
IRRIGATION, EL PASO	EL PASO COUNTY - EPCWID #1 - REGULATING RIVERSIDE RESERVOIR	PLANNING, DESIGN, PERMITTING & ACQUISITION FUNDING	$750,000	2021
IRRIGATION, EL PASO	EL PASO COUNTY - EPCWID #1 - REGULATING RIVERSIDE RESERVOIR	CONSTRUCTION FUNDING	$6,004,036	2022
IRRIGATION, EL PASO	EL PASO COUNTY - EPCWID #1 - REGULATING RIVERSIDE RESERVOIR	PERCENT STATE PARTICIPATION IN OWNING EXCESS CAPACITY	$0	
IRRIGATION, EL PASO	EL PASO COUNTY - EPCWID #1 - TAILWATER REUSE	PLANNING, DESIGN, PERMITTING & ACQUISITION FUNDING	$0	NA
IRRIGATION, EL PASO	EL PASO COUNTY - EPCWID #1 - TAILWATER REUSE	CONSTRUCTION FUNDING	$973,368	2025
IRRIGATION, EL PASO	EL PASO COUNTY - EPCWID #1 - TAILWATER REUSE	PERCENT STATE PARTICIPATION IN OWNING EXCESS CAPACITY	$0	
IRRIGATION, EL PASO	EL PASO COUNTY - EPCWID#1 - NEW WATERWAY 32 RIVER DIVERSION PUMPING POINT	PLANNING, DESIGN, PERMITTING & ACQUISITION FUNDING	$455,000	2021

Table 9-1. (continued) Infrastructure Finance Survey

Sponsor Entity Name	Project Name	IFR Element Name	IFR Element Value	Year of Need
IRRIGATION, EL PASO	EL PASO COUNTY - EPCWID#1 - NEW WATERWAY 32 RIVER DIVERSION PUMPING POINT	CONSTRUCTION FUNDING	$3,500,887	2022
IRRIGATION, EL PASO	EL PASO COUNTY - EPCWID#1 - NEW WATERWAY 32 RIVER DIVERSION PUMPING POINT	PERCENT STATE PARTICIPATION IN OWNING EXCESS CAPACITY	$0	
LAJITAS MUNICIPAL SERVICES	LAJITAS MUNICIPAL SERVICES - WATER LOSS AND MAIN-LINE REPAIR	PLANNING, DESIGN, PERMITTING & ACQUISITION FUNDING	NA	
LAJITAS MUNICIPAL SERVICES	LAJITAS MUNICIPAL SERVICES - WATER LOSS AND MAIN-LINE REPAIR	CONSTRUCTION FUNDING	$2,545,000	Ongoing
LAJITAS MUNICIPAL SERVICES	LAJITAS MUNICIPAL SERVICES - WATER LOSS AND MAIN-LINE REPAIR	PERCENT STATE PARTICIPATION IN OWNING EXCESS CAPACITY		
LOWER VALLEY WATER DISTRICT	LVWD - GROUNDWATER FROM PROPOSED WELL FIELD - HUECO BOLSON AQUIFER	PLANNING, DESIGN, PERMITTING & ACQUISITION FUNDING	$3,611,000	2024
LOWER VALLEY WATER DISTRICT	LVWD - GROUNDWATER FROM PROPOSED WELL FIELD - HUECO BOLSON AQUIFER	CONSTRUCTION FUNDING	$32,499,000	2025
LOWER VALLEY WATER DISTRICT	LVWD - GROUNDWATER FROM PROPOSED WELL FIELD - HUECO BOLSON AQUIFER	PERCENT STATE PARTICIPATION IN OWNING EXCESS CAPACITY	$75	
LOWER VALLEY WATER DISTRICT	LVWD - GROUNDWATER FROM PROPOSED WELL FIELD - RIO GRANDE ALLUVIUM AQUIFER	PLANNING, DESIGN, PERMITTING & ACQUISITION FUNDING	$3,923,600	2025
LOWER VALLEY WATER DISTRICT	LVWD - GROUNDWATER FROM PROPOSED WELL FIELD - RIO GRANDE ALLUVIUM AQUIFER	CONSTRUCTION FUNDING	$35,312,400	2026
LOWER VALLEY WATER DISTRICT	LVWD - GROUNDWATER FROM PROPOSED WELL FIELD - RIO GRANDE ALLUVIUM AQUIFER	PERCENT STATE PARTICIPATION IN OWNING EXCESS CAPACITY	$75	
LOWER VALLEY WATER DISTRICT	LVWD - SURFACE WATER TREATMENT PLANT AND TRANSMISSION LINES	PLANNING, DESIGN, PERMITTING & ACQUISITION FUNDING	$7,433,800	2025
LOWER VALLEY WATER DISTRICT	LVWD - SURFACE WATER TREATMENT PLANT AND TRANSMISSION LINES	CONSTRUCTION FUNDING	$66,904,200	2026
LOWER VALLEY WATER DISTRICT	LVWD - SURFACE WATER TREATMENT PLANT AND TRANSMISSION LINES	PERCENT STATE PARTICIPATION IN OWNING EXCESS CAPACITY	$80	

Table 9-1. (continued) Infrastructure Finance Survey

Sponsor Entity Name	Project Name	IFR Element Name	IFR Element Value	Year of Need
LOWER VALLEY WATER DISTRICT	LVWD - WASTEWATER TREATMENT AND ASR FACILITY	PLANNING, DESIGN, PERMITTING & ACQUISITION FUNDING	$2,350,900	2025
LOWER VALLEY WATER DISTRICT	LVWD - WASTEWATER TREATMENT AND ASR FACILITY	CONSTRUCTION FUNDING	$21,158,100	2026
LOWER VALLEY WATER DISTRICT	LVWD - WASTEWATER TREATMENT AND ASR FACILITY	PERCENT STATE PARTICIPATION IN OWNING EXCESS CAPACITY	$75	

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CHAPTER 10
PUBLIC PARTICIPATION
AND
PLAN ADOPTION

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10 PUBLIC PARTICIPATION AND PLAN ADOPTION

The Far West Texas Water Planning Group (FWTWPG) members recognized from the beginning the importance of involving the public in the planning process. Chapter 10 contains an overview of the FWTWPG representation, the Group's commitment to public involvement, and specific activities that insured that the public was informed and involved in the planning process and the implementation of the plan. Chapter 10 appendices contain responses to comments on the Initially Prepared Plan by the Public (Appendix 10A), TWDB (Appendix 10B), TPWD (Appendix 10C), and TSSWCB (Appendix 10D).

10.1 REGIONAL WATER PLANNING GROUP

The TWDB initially appointed a coordinating body for Far West Texas, based on names submitted by the public for consideration. Senate Bill 1 provisions mandate that one or more representatives of the following water user groups be seated on each water planning group: agriculture, counties, electric generating utilities, environment, industries, municipalities, river authorities, public, small business, water districts, and water utilities. The FWTWPG has since expanded its membership based on familiarity with persons who could appropriately represent industries, tourism, real estate and economic development. Because there is no river authority in Far West Texas, this sector is not represented; however, its function is maintained by El Paso County Water Improvement District #1, who is the primary representative of the Rio Grande Project. New to this planning period, additional voting members have been appointed to represent Groundwater Management Areas.

In addition to these required interest groups, the FWTWPG added the following: travel and tourism, groundwater conservation districts, building and real estate, economic development, Fort Bliss Garrison Command and legislative representatives. The voting members of the FWTWPG are only compensated for allowable travel expenses and have voluntarily devoted considerable amounts of their time and talent to develop the regional water plan. Current Planning Group members and their alternates are listed in Table 10-1.

Table 10-1. Current Group Members and Their Alternates

Water Use Category	Committee Member	County	Alternate Member	County
Agriculture	Rick Tate	Presidio		
Agriculture	Tim Leary	Brewster		
Real Estate	David Etzold	El Paso	Ray Adauto	El Paso
Counties	Teresa Todd	Jeff Davis	Val Beard	Brewster
Counties	Vacant			
Counties	Vincent Perez	El Paso	Jose Landeros	El Paso
Economic Develop.	Brad Newton	Presidio	John Anthony Razo	Presidio
Environment	Jeff Bennett	Brewster	Kevin Urbanczyk	Brewster
Elec. Generating Util.	Jessica Christianson	El Paso	Teresa Sosa	El Paso
GMA#4	Summer Webb	Culberson		
Groundwater Dist.	Randy Barker	Hudspeth	Talley Davis	Hudspeth
Groundwater Dist.	Janet Adams	Jeff Davis	Jim Espy	Jeff Davis
Industries	V.J. Smith	El Paso		
Municipalities	Becky Brewster	Culberson		
Municipalities	Scott Reinert	El Paso	John Belliew	El Paso
Municipalities	Vacant			
Public	Arlina Palacios	El Paso	Kathryn Hairston	El Paso
Public	Dave Hall	El Paso	Darryl S. Vereen	El Paso
Public	Sterry Butcher	Presidio	Patt Sims	Presidio
Small Business	Dan Dunlap	Presidio		
Travel/Tourism	Mike Davidson	Brewster	David Crum	Jeff Davis
Water Districts	Jim Ed Miller	Hudspeth	Bill Skov	El Paso
Water Districts	Chuy Reyes	El Paso	Johnny Stubbs	El Paso
Water Utilities	Albert Miller	Jeff Davis	Scott Adams	Jeff Davis

In addition to the FWTWPG members, 13 non-voting members are appointed. Their function is to provide advice and guidance, based on their respective areas of expertise or geographic areas. Two non-voting liaisons were assigned from Regions F and J adjacent to Far West Texas. The non-voting members and their alternates are listed in Table 10-2, while Officers and Executive Committee Members are listed in Table 10-3.

Table 10-2. Non-Voting Members and Their Alternates

Non-Voting Member	Agency/Organization	Alternate Member	Agency
Filiberto Cortez	USBR	Woody Irving/Mike Landis	USBR
Michael Lemonds	GLO		
William Finn	IBWC	Clifford Regensberg	IBWC
Hector Garza	USGS		
Zhuping Sheng	TX AgriLife Research		
Russell Martin	TPWD	Jonah Evans	TPWD
Rusty Ray	TSSWCB		
Ryan Slocum	Small Business		
Larissa Place	TDA		
BJ Tomlinson	Fort Bliss		

Table 10-3. Officers and Executive Committee Members

Member	Position
Chuy Reyes	Chairman
Scott Reinert	Vice-Chairman
Janet Adams	Secretary
Teresa Todd	EC Member
Rebecca Brewster	EC Member
Dave Hall	EC Member

Interregional Planning Council

The TWDB is required by Texas Water Code Section 16.052 to appoint an Interregional Planning Council made up of one member from each regional water planning group (RWPG). The purpose of the Council is to:

- Improve coordination among the RWPGs, and between the RWPGs and the TWDB in meeting goals of the state water planning process;
- Facilitate dialogue regarding regional water management strategies; and
- Share operational best practices of the regional water planning process.

The FWTWPG has appointed Scott Reinert to this position.

10.2 PROJECT MANAGEMENT

During the first planning cycle, work on the *Far West Texas Water Plan* was divided along two parallel tracks; (1) an urban track representing the metropolitan portion of El Paso County, and (2) a rural track representing the other six rural counties and the eastern portion of El Paso County. Work developed along the two-track approach was integrated at appropriate intervals to ensure a unified, coherent regional plan. During subsequent planning cycle, this approach was augmented, and the entire FWTWPG worked together on the *Regional Plan* from start to finish. However, the two tracks are still considered to ensure that voting membership is equally represented.

The planning decisions and recommendations made in the *Far West Texas Water Plan* will have far-reaching and long-lasting social, economic, and political repercussions on each community involved in this planning effort and on individuals throughout the Region. Therefore, involvement of the public is a key factor for the success and acceptance of the *Plan*. Open discussion and citizen input are encouraged throughout the planning process and helps planners develop a *Plan* that reflects community values and concerns. Some members of the public participate almost as non-voting members.

To insure public involvement, notice of all Planning Group and subcommittee meetings was posted in advance, mailed to a list of over 200 interested parties including mayors, county judges, water rights holders, public school superintendents, water districts, and concerned citizens; and e-mailed to an additional 350 interested parties. All meetings were held in publicly accessible locations with sites rotating among rural and urban locations throughout the counties in the Region. Special public meetings were held to gather input on the development of specific aspect of the *Plan*. Prior to submittal of the *Initially Prepared Plan* to the TWDB, a copy of the *Draft 2021 Far West Texas Water Plan* was provided for inspection in the county clerk’s office and in at least one library in each county, and online on the Rio Grande COG website. Following public inspection of the Initially Prepared Plan, one public meeting was conducted to present results of the planning process and gather public input and comments.

To provide a public access point, an internet web site http://westtexaswaterplanning.org/ contains timely information that includes names of planning group members, bylaws, meeting schedules, agendas, minutes, meeting backup materials, and important documents, including groundwater conservation district management plans, technical reports, draft chapters for review, planning schedules and budgets, and links to water-related sites. Summaries of most of the planning group meetings were e-mailed to the full list of interested parties, to enable persons who were unable to attend to stay up to date on the planning process. Every document that was e-mailed or mailed to Planning Group Members for their review was also e-mailed to the interested parties list, made available on the FWTWPG website, and provided in hard copy at all public meetings. In addition, news stories concerning water planning-related issues were regularly distributed to all interested parties.

10.3 PLANNING GROUP MEETINGS AND PUBLIC HEARINGS

All activities associated with the Regional Water Planning Process were performed in accordance with the State Open Meetings Act and in compliance with the Texas Public Information Act. All meetings of the FWTWPG, including committee meetings, were open to the public and visitors were encouraged to express their opinions and concerns, or to make suggestions regarding the planning process. The locations of the meetings were originally rotated between all seven counties so that all citizens within the Region would have an equal opportunity to attend. However, because of increased public attendance, the meetings were held predominantly in Alpine, Marfa, Van Horn and Clint, where adequate facilities could be arranged.

Meeting notices were posted in the following newspapers and were reported by the following radio stations:

- El Paso Inc.
- West Texas County Courier
- Hudspeth County Herald
- Van Horn Advocate
- Alpine Avalanche
- Jeff Davis County News/Mountain Dispatch
- Presidio International
- Big Bend Sentinel
- Terrell County News Leader
- KALP FM (Alpine)
- KVLF AM (Alpine)

A final public hearing was held in Clint, Texas on April 14, 2020 to receive comments on the *Initially Prepared Plan*. Responses to all public, TWDB and TPWD comments are included in this chapter as Appendix 10A, Appendix 10B and Appendix 10C.

Copies of the *Initially Prepared Plan* were available at the following locations:

County Clerk's Office:

- Brewster County
- Culberson County
- El Paso County
- Hudspeth County
- Jeff Davis County
- Presidio County
- Terrell County

Public Libraries:

- Alpine Public Library, 805 W. Ave E, Alpine
- Marathon Public Library, 106 N. 3rd, Marathon
- Big Bend High School Library, 550 Roadrunner, Terlingua
- Van Horn City-County Library, 410 Crockett St., Van Horn
- El Paso Public Library, 501 N. Oregon, El Paso
- Law Library, El Paso County Courthouse, 500 E. San Antonio
- Clint ISD/Public Library, 12625 Alameda, Clint
- Grace Grebing Public Library, 110 N. Main, Dell City
- Ft. Hancock ISD/Public Library, 101 School Drive, Ft. Hancock
- Jeff Davis County Library, 100 Memorial Square, Ft. Davis
- Marfa Public Library, 115 E. Oak, Marfa
- City of Presidio Library, 2440 O'Reilly St., Presidio
- Valentine Public Library, Valentine
- Terrell County Public Library, 105 E. Hackberry, Sanderson

The final *2021 Far West Texas Water Plan* was adopted by the FWTWPG on October 28, 2020 and was delivered to the TWDB by November 4, 2020. The *Plan* is posted on the Planning Groups (Rio Grande Council of Governments) website: http://westtexaswaterplanning.org/.

10.4 COORDINATION WITH OTHER REGIONS

The FWTWPG has exchanged liaisons with adjoining Region F and the Plateau Region (Region J). The responsibility of the liaisons is to report on any issues of common interest between adjoining regions. The FWTWPG also coordinated with Region F on groundwater supplies in Jeff Davis County that were exported to Reeves County for municipal use.

10.5 PLAN IMPLEMENTATION

Following final adoption of the *2021 Far West Texas Water Plan*, copies of the *Plan* were provided to each municipality and county commissioner's court in the Region. An electronic copy of the *Plan* is also available on the RGCOG and TWDB web sites.

APPENDIX 10-A

PUBLIC COMMENTS AND RESPONSES

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PUBLIC COMMENTS AND RESPONSES

The Far West Texas Water Planning Group (FWTWPG) hosted a virtual (in response to COVID 19) Public Hearing on the Far West Texas Initially Prepared Plan (IPP) on April 14, 2020 in Clint Texas. The Planning Group received the following two comments provided by Dr. Zhuping Sheng of the Texas AgriLife Research:

1. There are studies or proposed work to assess feasibility of desalination of brackish water for irrigated agricultural production. Will this Plan consider this as one of the strategies for future water supplies in Region E? Should TWDB fund additional studies to evaluate this strategy for this region or other regions where brackish water could be an alternate source of water for agricultural irrigation? It may also help address elevated soil salinity issues on farm fields.

   FWTWPG Response *– The current 2021 Far West Texas Water Plan does not have a specific strategy pertaining to desalination of brackish water for agricultural irrigation use. However, the Planning Group recognizes the potential of this valuable resource and will consider its inclusion during the next planning period. Desalination of brackish groundwater for municipal supply is recommended and this concept should be expanded to the agricultural field. The FWTWPG agrees that additional funding for research is needed to expedite the introduction of this potential new source into the agricultural industry.*

2. With the economic slowdown resulting from the COVID 19 virus, are we expecting delays in the regional water planning process and delay or reduction in funding for implementation of selected (recommended) strategies?

   FWTWPG Response *– There is not expected to be any delays in completing the current 2021 Far West Texas Water Plan. The State Attorney General's office has allowed for virtual meetings to maintain public safety while still providing for public open meeting requirements. It is also anticipated that the TWDB will still be able to function fully without delays or reduction in funding processes.*

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APPENDIX 10-B
TWDB COMMENTS AND RESPONSES

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TWDB comments on the Initially Prepared 2021 Far West Texas (Region E) Regional Water Plan

Level 1: Comments, questions, and data revisions that must be satisfactorily addressed in order to meet statutory, agency rule, and/or contract requirements.

1. Chapter 5 and the State Water Planning Database (DB22). The plan includes the following recommended water management strategies (WMS) by WMS type, providing supply in 2020 (not including demand management): one *aquifer storage and recovery*, 15 *groundwater wells & other,* four *groundwater desalination*, two *other direct reuse*, and two *other surface water*. **Strategy supply with an online decade of 2020 must be constructed and delivering water by January 5, 2023**.
    a) Please confirm that all strategies shown as providing supply in 2020 are expected to be providing water supply by January 5, 2023. *[31 § TAC 357.10(21); Contract Exhibit C, Section 5.2]*
    b) Please provide the specific basis on which the planning group anticipates that it is feasible that the *aquifer storage and recovery*, four *groundwater desalination*, and two *other surface water* WMSs will all actually be online and providing water supply by January 5, 2023. For example, provide information on actions taken by sponsors and anticipated future project milestones that demonstrate sufficient progress toward implementation. *[31 § TAC 357.10(21); Contract Exhibit C, Section 5.2]*
    c) In the event that the resulting adjustment of the timing of WMSs in the plan results in an increase in near-term unmet water needs, please update the related portions of the plan and DB22 accordingly, and also indicate whether 'demand management' will be the WMS used in the event of drought to address such water supply shortfalls or if the plan will show these as simply 'unmet'. If municipal shortages are left 'unmet' and without a 'demand management' strategy to meet the shortage, please also ensure that adequate justification is included in accordance with 31 TAC § 357.50(j). *[TWC § 16.051(a); 31 § TAC 357.50(j); [31 TAC § 357.34(i)(2); Contract Exhibit C, Section 5.2]*
    d) **Please be advised that, in accordance with Senate Bill 1511, 85th Texas Legislature, the planning group will be expected to rely on its next planning cycle budget to amend its 2021 Regional Water Plan during development of the 2026 Regional Water Plan, if recommended WMSs or projects become infeasible, for example, due to timing of projects coming online.** Infeasible WMSs include those WMSs where proposed sponsors have not taken an affirmative vote or other action to make expenditures necessary to construct or file applications for permits required in connection with implementation of the WMS on a schedule in order for the

WMS to be completed by the time the WMS is needed to address drought in the plan. *[Texas Water Code § 16.053(h)(10); 31 TAC § 357.12(b)]*

2. Chapter 1, Section 1.3.4, page 1-25. The definition of major water provider (MWP) presented in Section 1.3.4 refers to an old definition of a wholesale water provider.

   The correct definition of MWPs is presented in Section 2.2.1. Please update the Section 1.3.4 definition and list in the final, adopted regional water plan. *[31 TAC § 357.30(4)]*
3. Chapter 2, page 2-11, Table 2-3. Please revise the table header "Wholesale Water Provider" to "Major Water Provider" in the final, adopted regional water plan. *[31 TAC § 357.31(b)]*
4. Chapter 2, page 2-14, Table 2-5. Water demands presented for Terrell County-Other appear to be inconsistent with Board-adopted water demand projections. Table 2-5 presents Terrell County-Other decadal water demands as 100 ac-ft/year in 2020, 112 ac-ft/yr in 2030, 123 ac-ft/yr in 2040, 139 ac-ft/yr in 2050, 153 ac-ft/yr in 2060, and 166 ac-ft/yr in 2070. TWDB Board-adopted water demands for Terrell County-Other are 21 ac-ft/yr in 2020 and 2030 and 20 ac-ft/yr each decade from 2040 to 2070. Please include Board-adopted water demands for Terrell County-Other in the final, adopted regional water plan. *[31 TAC § 357.31(e)(1)]*
5. Pages 3-4 and 3-7. Total existing supplies presented in Table 3-2 for Culberson County and Region E Total appear to be inconsistent with total existing supplies reported in DB22. Please reconcile this information as necessary in the final, adopted regional water plan. *[31 TAC § 357.32(g)]*
6. Page 3-7, Table 3-3. Direct reuse and Hueco-Mesilla Bolson Aquifer supplies presented for El Paso Water appear to be inconsistent with existing supplies for the entity reported in Table 3-2 and in DB22. Please review direct reuse and Hueco-Mesilla Bolson Aquifer supplies for El Paso Water and reconcile as necessary in the final, adopted regional water plan. *[31 TAC § 357.32(g)]*
7. Page 3-7, Table 3-3. Please revise the column header "Wholesale Water Provider" to "Major Water Provider" in the final, adopted regional water plan. *[31 TAC § 357.32(g)]*
8. Section 3.4. It is not clear what methodology was used to calculate direct reuse supplies discussed in Section 3.4. Please provide a more detailed explanation of the methodology used to calculate reuse supplies in the final, including as relates to existing treatment capacity, in the final, adopted regional water plan. *[Contract Exhibit C, Section 3.4]*
9. Chapter 3, page 3-25. Table 3-6 does not appear to include the methodology for estimating the West Texas Bolson Aquifer (Wild Horse, Michigan, and Lobo) non-modeled available groundwater volumes for Jeff Davis County. Please include the methodology used to estimate availability for this source in the final, adopted regional water plan. *[Contract Exhibit C, Section 3.5.2]*

10. Chapter 3. Please include a summary with information on the Water Availability Model (WAM) version, WAM simulation date, and WRAP version used for surface water simulations in the final, adopted regional water plan. *[Contract Exhibit C, Section 3.2.1]*
11. Chapter 4. The plan does not appear to include identified water need volumes for MWPs reported by category of use including municipal, mining, manufacturing, irrigation, steam electric, mining, and livestock. Please report the results of the needs analysis for MWPs by categories of use as applicable in the region in the final, adopted regional water plan. *[31 TAC § 357.33(b)]*
12. Chapter 4. The plan does not appear to include a secondary needs analysis for MWPs. Please present the results of the secondary needs analysis by decade for MWPs in the final, adopted regional water plan. *[31 TAC § 357.33(e)]*
13. Page 4-4. Table 4.3 does not report secondary water needs for El Paso County steam electric power and manufacturing as compared to the secondary needs reported in DB22. Please reconcile these items in the final, adopted regional water plan. *[31 TAC § 357.33(e)]*
14. Section 5.2.6, Tables 5-2 to 5-4, and Appendix 5A appears to present inconsistent information on recommended and alternative WMSs for El Paso Water from what is reported in the DB22. For example, Section 5.2.6 notes seven alternate WMSs for El Paso Water, Tables 5-2 to 5-4 and Appendix 5A present six alternate WMSs for El Paso Water, and data reported in DB22 includes three alternate WMSs for El Paso Water. Please reconcile this information as necessary and ensure that all recommended or alternative strategies and projects are entered into DB22 in the final, adopted regional water plan. *[31 TAC § 357.35(g)(1)]*
15. Pages 5-13, 5-15, and 5A-20. The strategy evaluation for E-25 reflects placeholder text "XXX" or provides no information in the description of quantity, reliability, and cost. Please provide this information in Appendix 5A, Table 5-2, and Table 5-3 in the final, adopted regional water plan. *[Contract Exhibit C, Section 5.6]*
16. Section 5A-1.1, page 5A-3. The evaluation for strategy E-2 makes clear that the project is primarily to reduce flooding and will not provide reliable supply during severe drought conditions. Please either remove the strategy from the plan as presented since it clearly does not meet the requirement in 31 § TAC 357.34(b), or modify the strategy to provide reliable water supply during severe drought conditions and present the reliable yield and unit cost along with calculations showing the basis for the reliable yield calculation in the final, adopted regional water plan. *[31 TAC § 357.34(b)]*
17. Section 5A-11, page 5A-34. Based on the information presented in the plan for strategy evaluation E-44, it is not clear if the 5,000 acre-ft yield is a net quantity of water saved from delivery efficiencies or a total delivery volume that may include existing supplies. Please clarify whether or not the reported yield includes existing supplies. If the yield includes existing supplies, please present the net yield

produced from the strategy in the final, adopted regional water plan and make any associated adjustments to DB22. *[31 TAC § 357.34(e)(3)(A)]*

18. Page 5A-13, Strategy E-15. The plan does not appear to present separately the land costs associated with the reservoir. Please include separated reservoir-associated land costs or, if appropriate, indicate that land acquisition costs are not applicable, and why to this strategy in the final, adopted regional water plan. *[Contract Exhibit C, Section 5.5]*
19. Page 5A-39, Strategy E-53. The strategy is indicated to be a conservation strategy and represented as demand reduction in DB22, even though the description states the WMS is to replace an old pipeline that needs major repair and includes a booster station and pumping station. The plan also states that the estimated water loss is only 3.8 percent. The primary purpose of water loss conservation WMSs must result in an immediate reduction in use or water loss, per contract guidance. Infrastructure costs primarily associated with maintenance are not allowed to be included in the plan. Please ensure that only infrastructure costs that are required to increase the volume of water supply are included in the final, adopted regional water plan and that operation and infrastructure maintenance projects and costs are not included. *[Contract Exhibit C, Section 5.5.3]*
20. Page 5A-45. Please include a generally defined delivery point for water in the strategy evaluation for E-65, Additional Wells in the Edwards-Trinity (Plateau) Aquifer, in the final, adopted regional water plan. *[Contract Exhibit C, Section 5.7]*
21. Appendix 5A. The plan in several instances, for example, evaluations E-45, E-47, E-49, E-57, and E-64, presents mining conservation strategies with zero costs and yet also notes an assumption that there are strategy costs and that these are assumed to be paid back within a year. Please report the initial one-time costs for these strategies against which cost savings are based in the final, adopted regional water plan. *[31 TAC § 357.34(e)(3)(A); Contract Exhibit C, Section 5.5]*
22. Appendix 5A. The plan in some instances appears to include infrastructure components that are not directly required to increase the treated water supply either as new supply or through demand reduction. For example, E-1 appears to include costs for installation of an irrigation system and E-17 appears to include costs for rehabilitation of existing wells which is not allowed per contract guidance.

    Please ensure that only infrastructure costs that are required to increase the volume of water supply are included in the final, adopted regional water plan and that operation and infrastructure maintenance costs are not included. *[Contract Exhibit C, Section 5.5.3]*
23. Page 5A-6. The evaluation for strategy E-8 notes that wells and booster stations are in critical need of system upgrades and alternate power supplies, in addition to old and undersized distribution lines. It is not clear if these items are included as project

components and how maintenance of this existing equipment would directly increase the water supply volumes. Please provide a breakout of project components with capital costs and do not include any costs for maintenance of, or upgrades to, or rehabilitation to existing equipment that do not directly increase the volumetric water supply in the final, adopted regional water plan. *[Contract Exhibit C, Section 5.5.3]*

24. Page 5A-20. The evaluation for strategy E-25 appears to present a project to address distribution system pressurization requirements. Distribution-level projects are not appropriate for inclusion in the regional water plans per Contract Exhibit C, Section 5.5.3. Please ensure projects not required to increase the volume of water supply that is delivered to a WUG (e.g., via transmission) are omitted from the final, adopted regional water plan. *[Contract Exhibit C, Section 5.5.3]*
25. Chapter 5. The plan presents the documented process for identifying potentially feasible WMSs but does not appear to include the description of the process of selecting recommended WMS and WMS projects. Please include documentation of the process of selecting recommended WMSs and WMS projects in the final, adopted regional water plan. *[Contract Scope of Work, Task 5A subtask 5]*
26. Chapter 5. Please include documentation of why seawater desalination was not selected as a recommended WMSs in the final, adopted regional water plan. *[TWC § 16.053(e)(5)(j); Contract Exhibit C, Section 5.2; 31 § TAC 357.34(g)]*
27. Chapter 5. It is not clear from the plan what methodology was used to estimate the amount of future direct reuse water available from such sources. Please describe the methodology in the final, adopted regional water plan. *[Contract Exhibit C, Section 3.4]*
28. Chapter 5. It is not clear from the plan if or how environmental flow criteria were taken into account in the evaluation of the Riverside Regulating Reservoir strategy. Please confirm whether there would be a new appropriation of surface water required for this strategy, and if so, please clarify how environmental flow criteria were considered in strategy evaluations and document this information in the final, adopted regional water plan. *[31 TAC § 357.34(e)(3)(B); 31 TAC § 358.3(22); 31 TAC § 358.3(23)]*
29. Chapter 5. It is not clear if third-party social and economic impacts resulting from voluntary redistributions of water, including impacts of moving water from rural and agricultural areas, were considered in the evaluation of potentially feasible WMSs. Please clarify how these impacts were considered (or clarify if there are no impacts) in the final, adopted regional water plan. *[31 TAC § 357.34(e)(7)]*
30. Chapter 5. The plan does not appear to present management supply factors for MWPs. Please present management supply factors for MWPs by entity and decade in the final, adopted regional water plan. *[31 TAC § 357.35(g)(2)]*
31. Appendix 5A. The plan in some instances, presents WMSs as providing supplies in a

given planning decade but notes the strategy is not expected to come online until after the initial year of the decade. For example, strategy evaluations E-1, E-2, E-13, E-14, appear to come online after the initial decade year they are shown as providing supply in. Please modify the online decade of these strategies to ensure that WMSs shown as providing supply in a planning decade come online in or prior to the initial decade year in the final, adopted regional water plan. In the event that the resulting adjustment of the timing of WMSs in the plan results in an increase in near-term unmet water needs, please update the related portions of the plan and DB22 accordingly *[31 TAC § 357.10(21); Contract Exhibit C, Section 5.2]*

32. Chapter 5. The plan does not include the WMS project costing tool's output report for projects or analogously present the capital cost for each project component. Please submit the costing tool's standardized cost output report or present capital cost estimates for each project component for each WMS evaluated in the final, adopted regional water plan. *[31 TAC § 357.34(f); 31 TAC § 358.3(21); Contract Exhibit C, Section 5.5.1]*
33. Chapter 5 and Appendix 5A. From the information presented in the plan, it is not clear that all required capital cost components were evaluated for each strategy. For example, capital costs should consider the following as applicable: construction costs, engineering and feasibility studies, legal assistance, financing, bond counsel and contingencies, permitting and mitigation, land purchase not associated with mitigation, easement costs, and purchases of water rights. Please clarify the cost elements that were included in the strategy evaluations in the final, adopted regional water plan. *[Contract Exhibit C, Section 5.5]*
34. Units costs reported in DB22 appear notably high for the Hudspeth County - Hudspeth Co. WCID #1 - Replace Water Supply Line from Van Horn WMS. Unit costs are reported as $37,282 in 2020 and 2030. Please confirm that the calculated unit costs are correct in DB22 and that costs were considered in WMS recommendations in the final, adopted regional water plan. *[31 TAC § 357.34(e)(2)]*
35. Page 5A-28. The plan appears to indicate that strategies E-37, E-38, and E-39 are intended to provide supplies for El Paso County-Other Vinton Hills Estates and County-Other Vinton Hills Subdivision. In DB22, strategy supplies for E-37, E-38, and E-39 appear to be assigned only to El Paso County-Other Vinton Hills Estates, leaving El Paso County-Other Vinton Hills Subdivision with unmet needs. Please reconcile the information presented in Table 4-4, Section 5A-10, and DB22 as necessary for the final, adopted regional water plan. *[31 TAC § 357.40(c)]*
36. Page 5-11. Section 5.2.7 notes that sufficient WMS supplies are recommended to meet the identified water needs of all WUGs except for irrigation needs in El Paso County. Table 4-4 and DB22 report unmet needs for several other WUGs including El Paso and Terrell County Mining and Culberson County Irrigation. Please reconcile this information as necessary in the final, adopted regional water plan. *[31 TAC § 357.40(c)]*
37. Section 5.4.7. The plan states that needs are met for all WUGs, however data reported in DB22 reflects unmet needs for Horizon Regional MUD and County-

Other, Vinton Hills Subdivision. Please reconcile this data as necessary in DB22 or provide an adequate justification of unmet needs for municipal WUGs as outlined in rule and contract guidance in the final, adopted regional water plan. *[31 TAC § 357.50(j); Contract Exhibit C, Section 6.3]*

38. Page 4-6, Table 4-4 and page 5-11, Section 5.2.7. It appears that identified unmet water needs are presented in Chapters 4 and 5 of the IPP. Please present discussion of unmet needs in Chapter 6 of the final, adopted regional water plan. *[31 TAC § 357.40(c)]*
39. Chapter 6. The plan does not appear to include a description of third-party social and economic impacts resulting from voluntary redistributions of water, including analysis of third-party impacts of moving water from rural and agricultural areas. Please include this information (or clarify if there are no impacts) in the final, adopted regional water plan. *[31 TAC § 357.40(b)(4)]*
40. Chapter 6. Please include a description of major impacts of recommended WMSs on key parameters of water quality in Chapter 6 of the final, adopted regional water plan. *[31 TAC § 357.40(b)(5)]*
41. Chapter 7, Section 7.3, page 7-20. The plan appears to include potential emergency interconnects in Table 7-2 but does not appear to include existing emergency interconnects or the methodology used to collect such information. Please include, at a minimum, a description of the methodology used to collect the information and the number of existing and potential interconnects, including who is connected to whom, in the final, adopted regional water plan. *[31 TAC § 357.42(d)]*
42. Section 7.4, page 7.21. Please confirm whether the entities evaluated for emergency responses to local drought conditions or loss of municipal supply were assumed to have 180 days or less of remaining supply. *[Contract Exhibit C, Section 7.4]*
43. Page7-36, Section 7.5.4. The plan does not appear to include copies of the model drought contingency plans, and the referenced online link to the model plans do not appear to link to the referenced documents at the time of plan review. Please ensure operational links to the model plans if they are to be included only by online reference in the final, adopted regional water plan. *[31 TAC § 357.42(j)]*
44. Chapter 7. Model drought contingency plans were not provided for review. Please ensure that model drought contingency plans submitted with the final, adopted regional water plan at a minimum have triggers and responses to 'severe' and 'critical/emergency' drought conditions. *[Contract Exhibit C, Section 7.6]*
45. Chapter 7. The plan does not appear to include a discussion of whether drought contingency measures have been recently implemented in response to drought conditions. Please describe this in the final, adopted regional water plan. *[Contract Scope of Work, Task 7, subtask 3]*
46. Section 8.4, page 8-7. The plan describes stream segments that were recommended as ecologically unique in previous planning periods. Many of these stream segments have already been designated as unique by the Texas Legislature. Of the segments

included in the plan, please clearly distinguish between those segments that have already been designated and those segments which remain as recommended for designation in the final, adopted regional water plan. *[31 TAC § 357.43(b); Contract Exhibit C, Section 8.1]*

47. Section 8.4, Page 8-7. It is not clear whether the planning group is intending to recommend unique stream sites that were recommended in a previous plan but not designated by the legislature (i.e. Alamito Creek in the Trans Pecos Water Trust and Terlingua Creek in Big Bend National Park (2017 State Water Plan, Chapter 2)). If the planning group is recommending these sites for consideration by the TWDB and potentially the legislature, a recommendation package must be submitted to Texas Parks and Wildlife Department (TPWD) for their written evaluation. A copy of the recommendation package, the status of the submittal, and TPWD's response to the request, must be included in the final, adopted regional water plan. *[31 TAC § 357.43(b)]*
48. Chapter 10. The plan notes that all meetings were held in accordance with the Texas Open Meetings Act but does not discuss compliance with the Texas Public Information Act. Please address how the planning group complied with the Texas Public Information Act in the final, adopted regional water plan. *[31 TAC §357.21; 31 TAC §357.50(f)]*
49. Chapter 11, Table 11-1. The plan did not include implementation survey data collected to date. Please ensure that the template and data used for the implementation survey in the final, adopted regional water plan are based on the survey template and data that the TWDB provided in June 2019. *[31 TAC § 357.45(a)]*
50. Page 11-6, Table 11-4. Groundwater source availability and total source supply values presented for the 2021 Plan in Table 11-4 appear to be inconsistent with availabilities presented in Table 3-1 and DB22. Please reconcile these items as necessary in the final, adopted regional water plan. *[31 TAC § 357.45(c)(3)]*
51. Pages 11-9 through 11-11. Existing supply information presented in Table 11-6 for Brewster County, El Paso County, and Far West Texas total existing supplies appear to be inconsistent with total existing supplies presented in Table 3-2 and DB22. Please reconcile these items as necessary in the final, adopted regional water plan. *[31 TAC § 357.45(c)(3)]*
52. Page 11-12, Table 11-8. Needs reported in Table 11-8 for Culberson County irrigation, El Paso Water, Paseo Del Este MUD 1, and El Paso County irrigation appear to be inconsistent with needs reported in Table 4-1 and DB22. Please reconcile these items as necessary in the final, adopted regional water plan. *[31 TAC § 357.45(c)(3)]*
53. Section 11.2.6 and Section 5.2.5. The text in these sections present a total capital cost of all recommended WMSs in the 2021 Plan as $2,169,328,445.00. This appears inconsistent with the reported total capital cost in DB22 of $1,926,613,983. Please reconcile these numbers as necessary in the final, adopted regional water plan. *[31 TAC § 357.45(c)(4)]*

54. Chapter 11, Section 11.2.6. Please provide a brief summary of how the 2016 Plan differs from the 2021 Plan with regards to alternative WMSs and WMS *projects* in the final, adopted regional water plan. *[31 TAC § 357.45(c)(4)]*

55. ES-Appendix. The plan includes some DB22 reports that appear blank due to the region not having relevant data for these reports. Please provide a cover page to the DB22 report appendix indicating the reason for these report contents being blank. *[Contract Exhibit C, Section 13.1.2]*

Level 2: Comments and suggestions for consideration that may improve the readability and overall understanding of the regional water plan.

1. Page ES-12. The plan states "new to this 2016 plan..." Please consider updating the reference from the 2016 plan to the 2021 plan and update the information on recommended unique stream segments as appropriate.
2. Page 1-42. Table 1-2 does not appear to include data for all of the utilities provided in TWDB water loss audit reports. Please review the water loss audit report information provided by the TWDB and consider presenting information for all utilities with 2015-2016 water loss audit reports. Please also consider utilizing data from the 2017 water loss audit reports in the final plan.
3. Chapter 2, page 2-11, Table 2-3. Please consider explaining what the percentages mean, as assigned to some entities in the Receiving Entity column, in the final plan.
4. Pages 2-17 and 5-28. The plan appears to inconsistently present the total percent of water used for irrigated agriculture in the region in Sections 2.2.4 and 5.2.7. Please consider revising this information as necessary in the final plan.
5. Page 3-25. The methodology presented in Table 3-6 for Other Aquifer (Balmorhea Alluvium) in Jeff Davis County appears to contain the following typo "22017 reported use by GCD". Please consider revising as necessary in the final plan.
6. Page 3-25, Table 3-6 notes the methodology for the Edwards-Trinity (Plateau) and Rustler aquifers as "GCD (non-relevant) TWDB modeled". Please consider clarifying if this includes pumping from the associated modeled available groundwater run that was compatible with the DFC, which was provided to planning groups for consideration.
7. Page 3-25, Table 3-6. Please consider providing additional information on the methodology used to determine Hueco-Mesilla Aquifer availability by, for example, naming or citing models or reports used to determine aquifer availability. This could be similar to the methodology information presented in item 14 of the 2018 Region E Technical Memorandum.
8. Section 5.2.7, page 5-11. Please consider including discussion of the unmet mining needs in the final plan.
9. Page 5A-4 states that the Study Butte Terlingua Water System is not an official WUG for regional water planning purposes, so that demand projections were not

developed for them by TWDB. Please consider adding clarification that Study Butte Terlingua Water System is planned for, and demand projections accounted for under the Brewster County-Other WUG.

10. Page 5A-9 states that reuse is considered a conservation strategy by the TWDB. While the TWDB acknowledges that the municipal conservation best practices guide includes reuse, for regional water planning purposes reuse is considered its own water source and should not be classified as conservation (with the exception of onsite mining recycling). Please consider clarifying this statement in the final, adopted regional water plan. *[Contract Exhibit C, Section 5.6]*
11. Chapter 5, pages 5A-19 to 5A-20, WMS E-24. The plan recommends Public Conservation Education as a conservation strategy with a capital cost but does not provide detail on what would be included in such a cost. Please consider specifying the capitalized costs for this strategy.
12. Chapter 5. In the electronic version of the plan, Section headings in Subchapter 5.5 appear to relate to Subchapter 5.3. Please review the section numbering in Subchapter 5.5 and revise as necessary to correspond with the appropriate subchapter.
13. Page 5-22. Please consider including that all entities with 3,300 or more connections and/or a financial obligation with TWDB greater than $500,000 are also required to submit water conservation plans.
14. Chapter 7. Please consider including all of the potential emergency interconnects noted in Table 7-2 in the list of potential emergency interconnects in Table 7-3, if appropriate.
15. Table of Contents. The section title for Section 5.2 in the table of contents has a typo. Please consider correcting EVAULATION to EVALUATION in the final plan.
16. Table of Contents. The table of contents appears to contain inconsistent references for the contents of Section 5.2 in the draft plan. Please review and revise as necessary in the final plan.
17. The GIS files submitted for WMS projects do not adhere to the contractually required naming convention. Please rename the GIS files following the naming convention outlined in Contract Exhibit D, Section 2.4.5 in the final GIS files submitted. *[Contract Exhibit D, Section 2.4.5]*
18. The GIS files submitted for WMS projects do not include all of the required attribute fields listed in Table 1 of Contract Exhibit D, Section 2.4.5. Please include the following attribute fields in all submitted WMS project GIS data with the final GIS files submitted: Sponsor, Name, Location Description, Project Components, and Datum. *[Contract Exhibit D, Section 2.4.5]*

RESPONSE TO TWDB COMMENTS

<u>LEVEL 1:</u>

1a. The following ten strategies listed in the IPP have been changed to a starting decade of 2030 (See response 1b below).

- City of Alpine – Modification of wastewater treatment facility ---
- City of Alpine – Irrigation and recharge application of captured rainwater
- Lower Valley Water District – Surface water treatment plant - - -
- Lower Valley Water District – Groundwater from proposed wellfield
- Lower Valley Water District – Groundwater from proposed wellfield
- Lower Valley Water District – Wastewater treatment facility and ASR
- El Paso County Irrigation (EPCWID#1) – Riverside regulating reservoir
- Hudspeth County Other (Dell City) – Brackish groundwater desal facility
- Hudspeth County Other (Sierra Blanca) – Replace water line from Van Horn
- Fort Davis WSC – Transmission line connecting to Fort Davis Estates

1b. The remaining strategies listed as starting in the 2020 decade could feasibly be implemented by January 5, 2023.

- All conservation strategies can be implemented immediately at the discretion and need of the WUG.
- All water loss audit and main-line repairs can be implemented in a very short time at the discretion of the WUG.
- Groundwater well projects can be implemented within approximately one year at the discretion of the WUG.
- Town of Anthony arsenic treatment and groundwater well are already partially funded and pre-engineering work is expected to commence soon.
- El Paso Water Bustamante WWTP has commenced pre-engineering work.
- Horizon Regional MUD is currently updating their facilities to meet anticipated demand growth.
- All purchase water from EPW involves ongoing contracts with no interruption.
- El Paso County Irrigation – EPCWID#1 new Westway 32 river diversion point is in design and construction expected soon.

1c. The only unmet need resulting from the above strategy starting decades being moved to 2030 occurs with El Paso County Irrigation (EPCWID#1). The irrigation district experiences a shortage (unmet need) because of very little water passing down the Rio Grande during a drought of record. Even if the Riverside Regulating Reservoir strategy were left in place in 2020, the District would still experience a shortage.

1d. The Far West Texas Planning Group acknowledges that they will be expected to rely on its next planning cycle budget for any required Plan amendments.

2. Definition of Major Water Provider in Ch 1 Sec 1.3.4 is revised.

3. Ch 2 Table 2-3 header is revised to Major Water Provider.

4. Ch 2 Table 2-5 is revised to reflect correct demand for Terrell County-Other and for the Region Total.
5. Ch 3 Table 3-2 Culberson Irrigation use from the Capitan Reef Aquifer is revised to show zero availability from 2040 to 2070. Total regional supply also revised for 2040 through 2070 decades.
6. Ch 3 Table 3-3 is revised to show correct direct reuse and Hueco-Mesilla Aquifer supplies for El Paso Water. Also, corrected incorrect Rio Grande Alluvium Aquifer supply for El Paso County WID#1.
7. Heading in Ch 3 Table 3-3 is revised to show Major Water Provider.
8. Methodology for calculating Reuse supply availability is provided in Ch 3 Sec 3.4. Also, Reuse supplies reported for the City of Alpine, Brewster County have been revised in Tables 3-1 and 3-2.
9. TWDB GAM Report (GAM Run 16-030 MAG) for Groundwater Management Area 4 (Feb. 2018) page 32 does not list an availability from the Wild Horse, Michigan, and Lobo segments of the West Texas Bolsons Aquifer in Jeff Davis County. To avoid the confusion, these segments are eliminated from the West Texas Bolsons sub-aquifers in Jeff Davis County in Ch 3 Tables 3-1 and 3-2. The remaining Green River Valley and Ryan Flat segments of the West Texas Bolsons Aquifer are correct.
10. Rio Grande WAM descriptive information provided in second paragraph of Ch 3 Sec 3.1.
11. A Major Water Provider needs analysis by category of use is presented in Ch 4 Table 4-4.
12. A secondary water needs analysis is provided for Major Water Providers in Ch 4 Table 4-5.
13. El Paso County Steam Electric Power secondary needs is added to Ch 4 Table 4-3.
14. Database has been updated to reflect strategies listed in Table 5-2 (5 recommended and 9 alternate). Ch 5 Sec 5.2.6 has also been updated to show nine EPW alternate strategies and one Terrell County mining alternate strategy.
15. Lower Valley Water District Strategy E-25 is eliminated, and line deleted from Tables 5-2, 5-3, and 5-4.
16. Statement of "The project supply is considered interruptible during severe drought conditions" is removed from Strategy J-2. Strategy name is changed to "Irrigation and recharge application of captured rainwater runoff". Reliability is changed from a 2 to a 1 in Table 5-2. Text is revised to indicate that the project is not primarily intended to reduce flooding, but rather to capture beneficial supply and encourage recharge. Calculations are shown that the three catchment basins with a total area of 70 acres will capture rainfall at a rate of 12 inches a year under drought conditions, which will generate approximately 70 acre-feet of supply per year. Unit cost is shown in Table 5-3.
17. Ch 5 Strategy E-44 is revised to describe that the 5,000 acre-feet per year is "additional water supply as a result of delivery efficiencies.

18. EPCWID#1 has already purchased this property. Strategy E-15 is revised to state this purchase.
19. Strategy E-53 for the City of Sierra Blanca is revised to describe only allowable infrastructure components and DB22 is corrected to show proper source.
20. A general location of the central part of the county is added to Strategy E-65 description.
21. Strategies E-45, 47, 49, 57 and 64 have been eliminated. Capital costs for these privately owned and operated WUGs are beyond the scope of this planning process. Unmet needs resulting from the elimination of these strategies is discussed in Ch 5 Sec 5.2.8.
22. Discussion in Strategies E-1 and E-17 is revised to describe only allowable infrastructure components.
23. Strategy E-8 for the City of Anthony has been revised to not describe non-allowable infrastructure components.
24. Lower Valley Water District Strategy E-25 is eliminated, and line deleted from Tables 5-2, 5-3, and 5-4.
25. A statement describing the selecting recommended strategies is added to Ch 5 Sec 5.2.5.
26. A statement explaining why seawater desalination was not selected as a strategy is added to Ch 5 Sec 5.2.5.
27. A discussion pertaining to direct reuse strategies is added in Ch 5 Section 5.5.5.
28. EPCWID#1 Riverside Regulating Reservoir strategy estimates new supply based on increased delivery efficiency in the canal delivery system after diversion from the river, and therefore, environmental flow consideration is not required for this evaluation. Added language to the strategy text for clarity.
29. A statement explain how third-party social and economic impacts of moving water from rural and agricultural areas is provided in Ch 5 Sec 5.2.5.
30. Management Supply Factors for Major Water Providers is added to Ch 5 Sec 5.2.1.
31. Text revisions are made to list the appropriate decade for strategies E-1, E-2, E-13 and E-14. Also, the starting decade for several other strategies have been changed to 2030 (see response 1a).
32. The costing tool's output report is provided for all required projects and capital costs are presented in for all project strategies in Chapter 5 Tables 5-2 and 5-3.
33. A description of capital cost eligible elements are included in Ch 5 Sec 5.2.1.
34. Unit costs for Strategy E-53 Sierra Blanca are confirmed.
35. The Vinton Hills strategies have been revised to represent both VH Estates and VH Subdivision. Supply and cost have been split appropriately between the entities in DB22 such that no unmet needs will appear.
36. Additional entities with water supply needs (as shown in Table 4-7) are provided in Ch 5 Sec 5.2.8.

37. Ch 5 Sec 5.2.8 is revised to discuss unmet water needs that match DB22.
38. A discussion on unmet water needs is added to the first page and paragraph of Ch 6 and in a new Sec 6.4.
39. A statement explain how third-party social and economic impacts of moving water from rural and agricultural areas is provided in the first page of Ch 6.
40. Impacts to key parameters of water quality are discussed in the last paragraph of Ch 6 Sec 6.1.
41. Chapter 7 Sec 7.3 and Table 7-2 are revised to describe existing emergency interconnections.
42. Entities evaluated for emergency response with 180 days or less of remaining supply is stated in the second paragraph of Ch 7 Sec 7.4.
43. Model drought contingency plans are included in Appendix 7A.
44. Triggers and responses are included in the Municipal and Wholesale model drought contingency plans, but not for the Irrigation DCP.
45. A discussion on recently implemented drought contingency measures is provided in the fifth paragraph of Ch 7 Sec 7.2.
46. A statement is added to Ch 8 Sec 8.4 that all recommended ecologically unique stream segments have been designated by the Texas Legislature except the Alamito Creek (Texas Pecos Land Trust) and Terlingua Creek (Big Bend National Park), and that these two segments continue to be recommended. A descriptive package for these two recommended segments was provided to TPWD for their analysis and their comment letter will be posted in Chapter 8.
47. Further explanation of the status of the Alamito and Terlingua segments is provided in Ch 8 Sec 8.4. No new segments are being recommended.
48. Compliance with the Texas Public Information Act is added to Ch 10 Sec 10.3.
49. The 2016 strategy implementation survey results are provided in Ch 11 Table 11-1.
50. The previous draft Source Water Availability Comparison Table 11-4 has been eliminated and reference is made to the Source Data Comparison table in the Executive Summary.
51. The previous draft Existing Supplies Comparison Tables 11-5 and 11-6 have been eliminated and reference is made to the WUG Data Comparison table in the Executive Summary.
52. Ch 11 Table 11-8 (now 11-5) is corrected to show proper El Paso Irrigation needs.
53. Ch 5 Sec 5.2.6 is revised with correct total capital cost of $2,110,409,105. Ch 11 Sec 11.2.6 is correct. It was determined that there was an entry error in the DB22 for strategy E-11 EPW Bustamante.
54. A comparison of recommended and alternate water management strategy projects in the 2016 and 2021 Plans are compared in Ch 11 Sec 11.2.6 and in Tables 11-8 and 11-9.
55. A listing of all TWDB data tables are now provided on the ES Appendix cover page.

LEVEL 2:

1. The reference to the 2016 Plan was a mistaken carryover from the previous Plan. The sentence is omitted from this Plan.
2. The FWTWPG choses to retain the existing Ch 1 Table 1-2 as is currently displayed but corrected the table title and the paragraph above to qualify the entries in the table as those with more than a 10 percent loss. No entities reported more than a 10 percent loss in 2017.
3. Ch 2 Table 2-3 - Percentage relabeled as (% of total demand).
4. Ch 5 Page 5-28 – Total percent of water used for irrigation revised to 65 percent.
5. Date revised to 2017 for Balmorhea Aquifer use in Ch 3 Table 3-6.
6. Methodology explanation revised for Edwards-Trinity (Plateau) and Rustler Aquifers in Ch 3 Table 3-6.
7. Reference for Hueco-Mesilla Aquifer availability is added to Ch 3 Table 3-6.
8. Unmet mining needs are listed in Ch 5 Sec 5.2.7.
9. Statement for Study Butte Terlingua Water System is corrected to state that demand is accounted for under Brewster County-Other in Ch 5 Sec 5A-1.2 Strategy E-3.
10. EPW's reuse program is redefined in Ch 5 Sec 5A-4 Strategy E-10.
11. Strategy E-24 LVWD Public Conservation education capital cost has been revised in the Plan and the Database to $0.
12. Heading number has been revised from 5.5 to 5.3.
13. The suggested language is added to the last paragraph of Ch 5 Sec 5.3.1.
14. Ch 7 Table 7-3 is updated.
15. The spelling of Evaluation has been corrected in the Table of Contents Sec 5.2.
16. Contents have been updated in the Table of Contents Sec 5.2.
17. An attempt has been made to properly rename GIS files according to the naming convention outlines in the Guidelines.
18. An attempt has been made to include all required attribute fields in the GIS data.

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APPENDIX 10-C
TPWD COMMENTS AND RESPONSES

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June 15, 2020

Mr. Jesus "Chuy" Reyes, Chairman
Far West Texas Water Planning Group (Region E) 8037 Lockheed, Suite 100
El Paso, TX 79925

Re: 2021 Far West Texas Region E Initially Prepared Plan

Dear Mr. Reyes:

The Texas Parks and Wildlife Department (TPWD) has reviewed the 2021 Initially Prepared Regional Water Plan (IPP) for the Far West Texas Region E Water Planning Area and appreciates this opportunity to provide comments. Thank you for the Region's responsiveness to TPWD's comments in previous planning cycles. Water impacts every aspect of TPWD's mission to manage and conserve the natural and cultural resources of Texas. Although TPWD has limited regulatory authority over the use of state waters, we are the agency charged with primary responsibility for protecting the state's fish and wildlife resources. To that end, TPWD offers these comments intended to help avoid or minimize impacts to state fish and wildlife resources.

TPWD understands that regional water planning groups are guided by 31 TAC §357 when preparing regional water plans. These water planning rules spell out requirements related to natural resource and environmental protection. Accordingly, TPWD staff reviewed the IPP with a focus on the following questions:

- Does the IPP include a quantitative reporting of environmental factors including the effects on environmental water needs and habitat?
- Does the IPP include a description of natural resources and threats to natural resources due to water quantity or quality problems?
- Does the IPP discuss how these threats will be addressed?
- Does the IPP describe how it is consistent with long-term protection of natural resources?
- Does the IPP include water conservation as a water management strategy?
- Does the IPP include Drought Contingency Plans?
- Does the IPP recommend any stream segments be nominated as ecologically unique?
- Does the IPP address concerns raised by TPWD in connection with the 2016 Water Plan?

TPWD wholeheartedly agrees with statements pointing out the Region's economic health and quality of life are dependent upon sustainable water supply that is equitably managed as well as the recognition of the importance of protecting the environment and natural resources as necessary to supporting tourism in the region. Relative to the 2016 Region E Regional Water Plan, the 2021 IPP anticipates a nearly 20 percent decrease in future water needs by 2070, despite a projected population increase of 597,403 citizens over the same time period. Sixty-five percent of water use in the Region is by the agricultural sector in support of irrigation. Thirty percent is used by municipalities and the remaining

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5 percent supports manufacturing, steam-electric generation, livestock and mining. Increased municipal and agricultural water conservation, the most environmentally benign strategies, continue to be important Water Management Strategies (WMS) for the region. Other recommended WMS for meeting future water needs include increased water reclamation, groundwater recharge, additional groundwater development including brackish groundwater, importation of groundwater, stormwater capture, desalination of agricultural drain water and expansion of the Kay Bailey Hutchinson Desalination Plant. Disposal of brine concentrate from the Kay Baily Hutchinson Plant is via deep well injection, a preferred method of disposal for minimizing environmental impacts.

The Far West Texas IPP includes descriptions of natural resources and acknowledges the importance of protecting those resources. As in previous plans, the IPP includes a good discussion of the region's major springs and seeps that occur on state, federal, or privately owned conservation properties. Groundwater availability was assessed with the goal of not significantly lowering groundwater levels in order to maintain spring flows and ecosystems that depend on those springs as well as maintaining groundwater-surface interaction. Environmental and recreational water needs are discussed in Chapter 2. It would be appropriate to mention the Senate Bill 3 environmental flows process in this discussion.

Table 5-4 provides a comparative analysis of environmental impacts related to each WMS. TPWD appreciates the inclusion of Appendix 5B in response to our comments in 2015. Appendix 5B provides both quantitative and qualitative descriptions of impact ranges as well as a quantification of threatened and endangered species found in the county where the WMS is located. Each Recommended and Alternate WMS is given an Environmental Impact Factor score based on impacts to environmental water needs, wildlife habitat, cultural resources, environmental water quality and bays and estuaries. Environmental Impact Factors range from 1-5 where a score of 1 represents a positive impact and a score of 5 represents a significantly negative impact. For the most part each WMS scored 2 (no new impacts) or 3 (minimal impact). Two strategies received scores of 1 based on the potential to create aquatic habitat. There appears to be a typo in the title for Table 5B-3. Environmental Impact Category *Ranting* Matrix.

Chapter 6.3 describes how the IPP is consistent with the long term protection of natural resources. The Far West Regional Water Planning Group recognizes the economic importance of protecting the diverse environment of the area. Chapter 6.1 discusses how the protection of natural resources is closely linked with the protection of water resources, explaining that the methodology used to assess groundwater source availability was based on not significantly lowering water levels to a point where spring flows might be impacted. Ultimately TPWD would like to see adoption of groundwater management desired future conditions designed to protect springs, similar to those adopted by Groundwater Management Area 7 to protect Las Moras and San Felipe Springs located in Region F.

TPWD commends the Far West Texas Water Planning Group on its continued strong emphasis on water conservation and reuse. Of particular note is El Paso Water Utility's (EPWU) water conservation efforts that have reduced per capita municipal use in El Paso from about 200 gallons per capita per day (gpcd) in the 1990s to a current level of less than 130 gpcd, exceeding the Texas Water Conservation Task Force goal of 140 gpcd. EPWU anticipates additional reductions of 3 gpcd per decade over the fifty year planning

Mr. Jesus "Chuy" Reyes
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horizon. Water management and drought contingency plans for regional entities are discussed in detail in the IPP.

The IPP includes a proposed regulating reservoir to allow for more efficient use of previously authorized stored water releases from existing reservoirs upstream on the Rio Grande, as well as stormwater runoff. TPWD has previously commented on the importance of preserving periodic flood events in the Rio Grande for maintaining ecological processes including cottonwood regeneration, spawning of endemic and endangered fish species, and the redistribution of sediment within the river channel. Regulating flood events by diverting water that would otherwise flow into the Rio Grande will likely exacerbate the deteriorating ecological condition and hydrologic function of the Rio Grande.

TPWD commends the Far West Texas Regional Planning Group for once again nominating as ecologically unique stream segments that were nominated in the 2006, 2011 and 2016 Regional Water Plans. TPWD stands ready to provide any additional supporting information necessary to designate these segments as unique.

Thank you for your consideration of these comments. TPWD looks forward to continuing to work with the planning group to develop water supply strategies that not only meet the future water supply needs of the region but also preserve the ecological health of the region's aquatic resources. Please contact me at (512) 389-8715 or Cindy.Loeffler@TPWD.Texas.gov if you have any questions or comments.

Sincerely,

Cindy Loeffler

Cindy Loeffler,
Chief, Water Resources Branch

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RESPONSE TO TPWD COMMENTS

The Far West Texas Water Planning Group (FWTWPG) thanks the TPWD staff for their technical review and comments on the 2020 Plateau IPP and wish to express their appreciation for the agency's active role in the Far West Texas Water Planning process. The FWTWPG would also like to thank the TPWD staff for recognizing the concerted effort that the Planning Group has made to include environmental needs in the develop of this regional water plan. Following are responses to TPWD comments on the 2020 Far West Texas IPP:

1. TPWD – Suggestion to mention the Senate Bill 3 environmental flows process.

   FWTWPG – A discussion pertaining to the environmental flows process is added in the last paragraph of Chapter 2 Section 2.3.

2. TPWD – Suggestion to correct a typo in the title of Table 5B-3.

   FWTWPG – Typo has been corrected.

3. TPWD – Would ultimately like to see adoption of groundwater management desired future conditions designed to protect springs, similar to those adopted by Groundwater Management Area 7 to protect Las Moras and San Felipe Springs located in Region F *(Springs are in Region J)*.

   FWTWPG – A large majority of major springs in Far West Texas occur on State and Federal parkland where they receive a higher level of protection from outside influences. The FWTWPG supports the environmental commitment performed by park staff and is intent on including environmental water needs in the Regional Plan. Desired Future Conditions are beyond the responsibilities as set forth in Regional Water Planning guidelines, but the FWTWPG certainly agrees that using spring flow as a groundwater availability trigger is a reasonable method for establishing groundwater management protection.

4. TPWD – Concerned that diverting water during flood events will degrade the Rio Grande's natural ecological processes and will exacerbate its deteriorating ecological condition and hydrologic function.
   FWTWPG – The FWTWPG recognizes the beneficial impacts of periodic flood processes on downstream segments of the Rio Grande and will keep this function in mind as the Riverside Regulating Reservoir water management strategy is refined in the future.

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APPENDIX 10-D

TSSWCB COMMENTS AND RESPONSES

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TEXAS STATE SOIL AND WATER CONSERVATION BOARD
Protecting and Enhancing Natural Resources for Tomorrow

June 18, 2020

Mr. Jesus "Chuy" Reyes
Region E Chair

Dear Mr. Reyes;

For the past 2 years the Texas State Soil and Water Conservation Board (TSSWCB) has been participating in the Texas Water Development Board's (TWDB) Regional Water Planning meetings as directed by Senate Bill 1511, passed in the 2017 legislative session. We appreciate being included in the process and offer these constructive comments to the regional water plans and ultimately the State water plan. Attached you will find some specific comments to the Region E water plan as they pertain to the TSSWCB.

As you may know 82% of Texas' land area is privately-owned and are working lands, involved in agricultural, timber, and wildlife operations. These lands are important as they provide substantial economic, environmental, and recreational resources that benefit both the landowners and public. They also provide ecosystem services that we all rely on for everyday necessities, such as air and water quality, carbon sequestration, and wildlife habitat.

With that said, these working lands are where the vast majority of our rain falls and ultimately supply the water for all of our needs, such as municipal, industrial, wildlife, and agricultural to name a few. Texas' private working lands are a valuable resource for all Texans.

Over the years, the private landowners of these working lands have been good stewards of their property. In an indirect way they have been assisting the 16 TWDB's Regional Water Planning Groups in achieving their goals through voluntary incentive-based land conservation practices.

It has been proven over time if a raindrop is controlled where it hits the ground there can be a benefit to both water quality and water quantity. Private landowners have been providing benefits to our water resources by implementing Best Management Practices (BMP) that slow water runoff and provide for soil stabilization, which also slows the sedimentation of our reservoirs and allows for more water infiltration into our aquifers.

Some common BMPs include brush management, prescribed grazing, fencing, grade stabilization, irrigation land leveling, terrace, contour farming, cover crop, residue and tillage management, and riparian herbaceous cover.

The TSSWCB has been active with agricultural producers since 1939 as the lead agency for planning, implementing, and managing coordinated natural resource conservation programs for preventing and abating agricultural and sivicultural nonpoint sources of water pollution.

The TSSWCB also works to ensure that the State's network of over 2,000 flood control dams are protecting lives and property by providing operation, maintenance, and structural repair grants to local government sponsors.

The TSSWCB successfully delivers technical and financial assistance to private landowners of Texas through Texas' 216 local Soil and Water Conservation Districts (SWCD) which are led by 1,080 locally elected district directors who are active in agriculture. Through the TSSWCB Water Quality Management Plan Program (WQMP), farmers, ranchers, and silviculturalists receive technical and financial assistance to voluntarily conserve and protect our natural resources. Participants receive assistance with conservation practices, BMPs, that address water quality, water quantity, and soil erosion while promoting the productivity of agricultural lands. This efficient locally led conservation delivery system ensures that those most affected by conservation programs can make decisions on how and what programs will be implemented voluntarily on their private lands.

Over time lands change ownership and many larger tracts are broken up into smaller parcels. Most new landowners did not grow up on working lands and therefore may not have a knowledge of land management techniques. The TSSWCB is writing new WQMPs for these new landowners who are implementing BMPs on their land. Education and implementation of proper land management and BMPs continues to be essential. Voluntary incentive-based programs are essential to continue to address soil and water conservation in Texas.

These BMPs implemented for soil and water conservation provide benefits not only to the landowner but ultimately to all Texans and our water supply.

Respectfully,

Barry Mahler
Chairman

Rex Isom
Executive Director

Attachment:
Region E (Far West Texas)

- Page 10-3, Table 10-2. Non-Voting Members and Their Alternates
    - Rusty Ray TSW&SCB, should read Rusty Ray TSSWCB

RESPONSE TO TSSWCB COMMENTS

The Far West Texas Water Planning Group (FWTWPG) thanks the TSSWCB staff for their technical review and comments on the 2020 Plateau IPP and wish to express their appreciation for the agency's active role in the Far West Texas Water Planning process. The FWTWPG recognizes the many important functions performed by the TSSWCB and agrees that properly managing the State's natural resources, including land and water, will take the combined effort of all Texans. The correction suggested for Chapter 10 Table 10-2 has been corrected.

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CHAPTER 11

IMPLEMENTATION AND COMPARISON TO THE PREVIOUS REGIONAL WATER PLAN

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11 IMPLEMENTATION AND COMPARISON TO THE PREVIOUS REGIONAL WATER PLAN

Chapter 11 provides a survey of the level of implementation and identified impediments to the development of previously (*2016 Plan*) recommended Water Management Strategies that have affected progress in meeting projected water-supply needs. To best appreciate the continued improvements to the Far West Texas water planning process, this Chapter also offers a comparison of key components in the *2016 Far West Texas Water Plan* to those in this current *2021 Far West Texas Water Plan*. And, this Chapter also assesses the progress of the Far West Texas planning area in encouraging cooperation between water user groups for the purpose of achieving economies of scale and otherwise incentivizing strategies that benefit the entire region.

11.1 IMPLEMENTATION OF PREVIOUS REGIONAL WATER PLAN

Information needed to report on the level of implementation and identified impediments to the development of previously (*2016 Plan*) recommended Water Management Strategies that have affected progress in meeting projected water-supply needs was collected through a survey conducted by the Far West Texas Planning Group. Additional methods that were considered for identifying projects that may potentially have been implemented include:

- Tracking changes since the last Plan;
- Using TWDB funding records; and
- Using conservation implementation reports submitted to the TWDB.

Survey results are provided in Table 11-1.

Table 11-1. 2021 Far West Texas Strategy Implementation Survey

WMS or WMS Project Name	Database Online Decade	Related Sponsor Entity and/or Benefitting WUGs	Has Sponsor taken affirmative vote or actions? (TWC 16.053(h)(10))	If yes, in what year did this occur?	If yes, by what date is the action on schedule for implementation?	At what level of implementation is the project currently?*	If not implemented, why?* (When "If other, please describe" is selected, please add the descriptive text to that field)	What impediments presented to implementation?* (When "If other, please describe" is selected, please add the descriptive text to that field)	Current water supply project yield (ac-ft/yr)	Funds expended to date ($)	Project Cost ($)	Year the project is online?*	Is this a phased project?*	(Phased) Ultimate volume (ac-ft/yr)	(Phased) Ultimate project cost ($)	Year project reaches maximum capacity?*	What is the project funding source(s)?*	Funding Mechanism if Other?	Included in 2021 plan?*	Does the project or WMS involve reallocation of flood control?*	Does the project or WMS provide any measurable flood risk reduction?*	Optional Comments
BREWSTER COUNTY OTHER (MARATHON WSSSERVICE) - WATER LOSS AUDIT AND MAIN-LINE REPAIR	2020	PROJECT SPONSOR(S): COUNTY-OTHER (BREWSTER)																				
BREWSTER COUNTY OTHER (PANTHER JUNCTION BBNP PLT) - WATER LOSS AUDIT AND MAIN-LINE REPAIR	2020	PROJECT SPONSOR(S): COUNTY-OTHER (BREWSTER)																				
BREWSTER COUNTY OTHER (RIO GRANDE VILLAGE BBNP) - WATER LOSS AUDIT AND MAIN-LINE REPAIR	2020	PROJECT SPONSOR(S): COUNTY-OTHER (BREWSTER)																				
CITY OF MARFA - ADDITIONAL GROUNDWATER WELL	2020	PROJECT SPONSOR(S): MARFA	Yes	2019	2020	Under construction	If other, please describe. Pump meter has not been installed due to Covid issues.	Covid affecting all completion lead times.	376 ac-ft/yr	$600,000	$1,143,000	2020	No			2020	TWDB SWIFT		No	No	No	Covid 19 has affected all project lead times.
CITY OF PRESIDIO - ADDITIONAL GROUNDWATER WELL	2020	PROJECT SPONSOR(S): PRESIDIO																				
CITY OF PRESIDIO - WATER LOSS AUDIT AND MAIN-LINE REPAIR	2020	PROJECT SPONSOR(S): PRESIDIO																				
CITY OF SOCORRO - PUBLIC CONSERVATION EDUCATION	2020	WUG REDUCING DEMAND: SOCORRO																				
CITY OF SOCORRO - PURCHASE WATER FROM LVWD	2020	WMS SELLER: LOWER VALLEY WD; WMS SUPPLY RECIPIENT: SOCORRO																				

Table 11-2. (continued) 2021 Far West Texas Strategy Implementation Survey

WMS or WMS Project Name	Database Online Decade	Related Sponsor Entity and/or Benefitting WUGs	Has Sponsor taken affirmative vote or actions? (TWC 16.053(h)(10))	If yes, in what year did this occur?	If yes, by what date is the action on schedule for implementation?	At what level of implementation is the project currently?*	If not implemented, why?* (When "If other, please describe" is selected, please add the descriptive text to that field)	What impediments presented to implementation?* (When "If other, please describe" is selected, please add the descriptive text to that field)	Current water supply project yield (ac-ft/yr)	Funds expended to date ($)	Project Cost ($)	Year the project is online?*	Is this a phased project?*	(Phased) Ultimate volume (ac-ft/yr)	(Phased) Ultimate project cost ($)	Year project reaches maximum capacity?*	What is the project funding source(s)?*	Funding Mechanism if Other?	Included in 2021 plan?*	Does the project or WMS involve reallocation of flood control?*	Does the project or WMS provide any measurable flood risk reduction?*	Optional Comments
CITY OF VAN HORN - WATER LOSS AUDIT AND MAIN-LINE REPAIR	2020	PROJECT SPONSOR(S): VAN HORN																				
CITY OF VINTON - HIGH CAPACITY WATER LINES	2020	PROJECT SPONSOR(S): VINTON																				
CULBERSON COUNTY - ADDITIONAL GROUNDWATER WELL - WEST TEXAS BOLSONS AQUIFER	2020	PROJECT SPONSOR(S): MINING (CULBERSON)																				
CULBERSON COUNTY - ADDITIONAL GROUNDWATER WELLS - RUSTLER AQUIFER	2020	PROJECT SPONSOR(S): MINING (CULBERSON)																				
EL PASO CO. TORNILLO WID - ADDITIONAL GROUNDWATER WELL AND TRANSMISSION LINE	2020	PROJECT SPONSOR(S): EL PASO COUNTY TORNILLO WID	Yes	2016	2019	All phases fully implemented		Not applicable	645 ac-ft/yr	$1,136,432	$1,236,534	2020	No			2020	Federal - USDA		Yes	No	No	
EL PASO CO. TORNILLO WID - ARSENIC TREATMENT FACILITY	2020	PROJECT SPONSOR(S): EL PASO COUNTY TORNILLO WID	Yes	2016	2016	All phases fully implemented		Not applicable	968 ac-ft/yr	$3,614,000	$3,614,000	2017	No			2017	Federal - EPA		No	No	No	Project was placed online in March, 2017.
EL PASO COUNTY - EPCWID #1 - IMPROVEMENTS TO WATER DISTRICT DELIVERY SYSTEM	2020	PROJECT SPONSOR(S): IRRIGATION (EL PASO)																				
EL PASO COUNTY - MINING - ADDITIONAL GROUNDWATER WELLS	2020	PROJECT SPONSOR(S): MINING (EL PASO)																				

Table 11-3. (continued) 2021 Far West Texas Strategy Implementation Survey

WMS or WMS Project Name	Database Online Decade	Related Sponsor Entity and/or Benefitting WUGs	Has Sponsor taken affirmative vote or actions? (TWC 16.053(h)(10))	If yes, in what year did this occur?	If yes, by what date is the action on schedule for implementation?	At what level of implementation is the project currently?*	If not implemented, why?* (When "If other, please describe" is selected, please add the descriptive text to that field)	What impediments presented to implementation?* (When "If other, please describe" is selected, please add the descriptive text to that field)	Current water supply project yield (ac-ft/yr)	Funds expended to date ($)	Project Cost ($)	Year the project is online?*	Is this a phased project?*	(Phased) Ultimate volume (ac-ft/yr)	(Phased) Ultimate project cost ($)	Year project reaches maximum capacity?*	What is the project funding source(s)?*	Funding Mechanism if Other?	Included in 2021 plan?*	Does the project or WMS involve reallocation of flood control?*	Does the project or WMS provide any measurable flood risk reduction?*	Optional Comments
EL PASO COUNTY MANUFACTURING - PURCHASE WATER FROM EPWU	2020	WMS SELLER: EL PASO; WMS SUPPLY RECIPIENT: MANUFACTURING, EL PASO																				
EL PASO COUNTY OTHER - PURCHASE WATER FROM EPWU	2020	WMS SELLER: EL PASO; WMS SUPPLY RECIPIENT: COUNTY-OTHER, EL PASO																				
EL PASO SEP - PURCHASE WATER FROM EPWU	2020	WMS SELLER: EL PASO; WMS SUPPLY RECIPIENT: STEAM ELECTRIC POWER, EL PASO	Yes	Ongoing contract	Continuation of contract	Currently operating		Not applicable					No				Other	Company funds	Yes	No	No	RWP numbers largely underestimate total annualized purchase from EPW.
EPCWID #1 - IRRIGATION SCHEDULING	2020	WUG REDUCING DEMAND: IRRIGATION, EL PASO	Yes	Ongoing	2021	Under construction	Financing	Access to funding	402 ac-ft/yr	$125,000	$100,000 annually	2020	Yes	1,740 ac-ft/yr	$100,000 annually		TWDB - Other	TWDB Ag Water Conservation Grant; USBR	Yes	No	Potentially, but no technical flood analysis performed	
EPCWID #1 - TAILWATER REUSE	2020	WUG REDUCING DEMAND: IRRIGATION, EL PASO	No			Not implemented	Financing	Access to funding	Not implemented	$0	$973,368 annually		Yes	1,723 ac-ft/yr	$973,368 annually		TWDB - Other	TWDB Ag Water Conservation Grant; USBR	Yes	No	No	
EPWU - ADVANCED PURIFIED WATER AT THE BUSTAMANTE WWTP	2020	PROJECT SPONSOR(S): EL PASO																				
EPWU - EXPANSION OF LOCAL WELL FIELDS	2020	PROJECT SPONSOR(S): EL PASO																				
EPWU - EXPANSION OF THE JONATHAN ROGERS WWTP	2020	PROJECT SPONSOR(S): EL PASO																				

Table 11-4. (continued) 2021 Far West Texas Strategy Implementation Survey

WMS or WMS Project Name	Database Online Decade	Related Sponsor Entity and/or Benefitting WUGs	Has Sponsor taken affirmative vote or actions? (TWC 16.053(h)(10))	If yes, in what year did this occur?	If yes, by what date is the action on schedule for implementation?	At what level of implementation is the project currently?*	If not implemented, why?* (When "If other, please describe" is selected, please add the descriptive text to that field)	What impediments presented to implementation?* (When "If other, please describe" is selected, please add the descriptive text to that field)	Current water supply project yield (ac-ft/yr)	Funds expended to date ($)	Project Cost ($)	Year the project is online?*	Is this a phased project?*	(Phased) Ultimate volume (ac-ft/yr)	(Phased) Ultimate project cost ($)	Year project reaches maximum capacity?*	What is the project funding source(s)?*	Funding Mechanism if Other?	Included in 2021 plan?*	Does the project or WMS involve reallocation of flood control?*	Does the project or WMS provide any measurable flood risk reduction?*	Optional Comments
EPWU - EXPANSION OF THE KAY BAILEY HUTCHINSON DESAL PLANT	2020	PROJECT SPONSOR(S): EL PASO																				
EPWU - GROUNDWATER FROM SOUTHERN HUDSPETH COUNTY	2020	PROJECT SPONSOR(S): EL PASO																				
EPWU - MUNICIPAL CONSERVATION PROGRAMS	2020	WUG REDUCING DEMAND: EL PASO																				
EPWU - RECHARGE OF HUECO AQUIFER GROUNDWATER WITH TREATED SURFACE WATER	2020	PROJECT SPONSOR(S): EL PASO																				
EPWU - RIVERSIDE REGULATING RESERVOIR	2020	PROJECT SPONSOR(S): EL PASO																				
FORT BLISS - PUBLIC CONSERVATION EDUCATION	2020	WUG REDUCING DEMAND: FORT BLISS																				
FORT BLISS - PURCHASE WATER FROM EPWU	2020	WMS SELLER: EL PASO; WMS SUPPLY RECIPIENT: FORT BLISS																				
FORT DAVIS WSC - ADDITIONAL GROUNDWATER WELL	2020	PROJECT SPONSOR(S): FORT DAVIS	Yes	2018	Uncertain	Permit application submitted/pending	Permit constraints	If other, please describe. Need sanitary control easement from Fort Davis ISD.	107 ac-ft/yr	$250,000	$250,000	2020	No			2020	Other	Texas CDBG	Yes	No	No	

Table 11-5. (continued) 2021 Far West Texas Strategy Implementation Survey

WMS or WMS Project Name	Database Online Decade	Related Sponsor Entity and/or Benefitting WUGs	Has Sponsor taken affirmative vote or actions? (TWC 16.053(h)(10))	If yes, in what year did this occur?	If yes, by what date is the action on schedule for implementation?	At what level of implementation is the project currently?*	If not implemented, why?* (When "If other, please describe" is selected, please add the descriptive text to that field)	What impediments presented to implementation?* (When "If other, please describe" is selected, please add the descriptive text to that field)	Current water supply project yield (ac-ft/yr)	Funds expended to date ($)	Project Cost ($)	Year the project is online?*	Is this a phased project?*	(Phased) Ultimate volume (ac-ft/yr)	(Phased) Ultimate project cost ($)	Year project reaches maximum capacity?*	What is the project funding source(s)?*	Funding Mechanism if Other?	Included in 2021 plan?*	Does the project or WMS involve reallocation of flood control?*	Does the project or WMS provide any measurable flood risk reduction?*	Optional Comments
FORT DAVIS WSC - ADDITIONAL TRANSMISSION LINE	2020	PROJECT SPONSOR(S): FORT DAVIS	No			Not implemented	Too soon	Not applicable					No						Yes	No	No	
HORIZON CITY - PUBLIC CONSERVATION EDUCATION	2020	WUG REDUCING DEMAND: HORIZON CITY																				
HORIZON CITY - PURCHASE WATER FROM HORIZON REGIONAL MUD	2020	WMS SELLER: HORIZON REGIONAL MUD; WMS SUPPLY RECIPIENT: HORIZON CITY																				
HORIZON REGIONAL MUD - ADDITIONAL WELLS AND EXPANSION OF DESAL PLANT	2020	PROJECT SPONSOR(S): HORIZON REGIONAL MUD																				
HORIZON REGIONAL MUD - PUBLIC CONSERVATION EDUCATION	2020	WUG REDUCING DEMAND: HORIZON REGIONAL MUD																				
HUDSPETH COUNTY OTHER (CITY OF SIERRA BLANCA - HUDSPETH CO. WCID #1) - ADDITIONAL TRANSMISSION LINE	2020	PROJECT SPONSOR(S): COUNTY-OTHER (HUDSPETH)																				
HUDSPETH COUNTY OTHER (DELL CITY) - BRACKISH GROUNDWATER DESALINATION FACILITY	2020	PROJECT SPONSOR(S): COUNTY-OTHER (HUDSPETH)																				
HUDSPETH COUNTY OTHER (DELL CITY) - WATER LOSS AUDIT AND MAIN-LINE REPAIR	2020	PROJECT SPONSOR(S): COUNTY-OTHER (HUDSPETH)																				

Table 11-6. (continued) 2021 Far West Texas Strategy Implementation Survey

WMS or WMS Project Name	Database Online Decade	Related Sponsor Entity and/or Benefitting WUGs	Has Sponsor taken affirmative vote or actions? (TWC 16.053(h)(10))	If yes, in what year did this occur?	If yes, by what date is the action on schedule for implementation?	At what level of implementation is the project currently?*	If not implemented, why?* (When "If other, please describe" is selected, please add the descriptive text to that field)	What impediments presented to implementation?* (When "If other, please describe" is selected, please add the descriptive text to that field)	Current water supply project yield (ac-ft/yr)	Funds expended to date ($)	Project Cost ($)	Year the project is online?*	Is this a phased project?*	(Phased) Ultimate volume (ac-ft/yr)	(Phased) Ultimate project cost ($)	Year project reaches maximum capacity?*	What is the project funding source(s)?*	Funding Mechanism if Other?	Included in 2021 plan?*	Does the project or WMS involve reallocation of flood control?*	Does the project or WMS provide any measurable flood risk reduction?*	Optional Comments
HUDSPETH COUNTY OTHER (FORT HANCOCK WCID #1) - ADDITIONAL WELL AND RO TREATMENT FACILITY	2020	PROJECT SPONSOR(S): COUNTY-OTHER (HUDSPETH)																				
HUDSPETH COUNTY OTHER (FORT HANCOCK WCID) - WATER LOSS AUDIT AND MAIN-LINE REPAIR	2020	PROJECT SPONSOR(S): COUNTY-OTHER (HUDSPETH)																				
HUDSPETH IRRIGATION - HCCRD #1 - ADDITIONAL GROUNDWATER WELLS	2020	PROJECT SPONSOR(S): IRRIGATION (HUDSPETH)																				
HUDSPETH IRRIGATION - HCUWCD #1 - IRRIGATION SCHEDULING	2020	WUG REDUCING DEMAND: IRRIGATION, HUDSPETH																				
HUDSPETH IRRIGATION - HCUWCD #1 - TAILWATER REUSE	2020	WUG REDUCING DEMAND: IRRIGATION, HUDSPETH																				
HUDSPETH MINING - ADDITIONAL GROUNDWATER WELL	2020	PROJECT SPONSOR(S): MINING (HUDSPETH)																				
JEFF DAVIS COUNTY OTHER (TOWN OF VALENTINE) - ADDITIONAL GROUNDWATER WELL	2020	PROJECT SPONSOR(S): COUNTY-OTHER (JEFF DAVIS)	Yes	2019	Uncertain	Not implemented	Financing	Access to funding	52	$0	$900,000		No						Yes	No	No	Town is in need of well, but unable to afford loan component.
LVWD - GROUNDWATER FROM PROPOSED WELL FIELD - HUECO BOLSON AQUIFER	2020	PROJECT SPONSOR(S): LOWER VALLEY WD																				

Table 11-7. (continued) 2021 Far West Texas Strategy Implementation Survey

WMS or WMS Project Name	Database Online Decade	Related Sponsor Entity and/or Benefitting WUGs	Has Sponsor taken affirmative vote or actions? (TWC 16.053(h)(10))	If yes, in what year did this occur?	If yes, by what date is the action on schedule for implementation?	At what level of implementation is the project currently?*	If not implemented, why?* (When "If other, please describe" is selected, please add the descriptive text to that field)	What impediments presented to implementation?* (When "If other, please describe" is selected, please add the descriptive text to that field)	Current water supply project yield (ac-ft/yr)	Funds expended to date ($)	Project Cost ($)	Year the project is online?*	Is this a phased project?*	(Phased) Ultimate volume (ac-ft/yr)	(Phased) Ultimate project cost ($)	Year project reaches maximum capacity?*	What is the project funding source(s)?*	Funding Mechanism if Other?	Included in 2021 plan?*	Does the project or WMS involve reallocation of flood control?*	Does the project or WMS provide any measurable flood risk reduction?*	Optional Comments
LVWD - GROUNDWATER FROM PROPOSED WELL FIELD - RIO GRANDE ALLUVIUM AQUIFER	2020	PROJECT SPONSOR(S): LOWER VALLEY WD																				
LVWD - PUBLIC CONSERVATION EDUCATION	2020	WUG REDUCING DEMAND: LOWER VALLEY WD																				
LVWD - PURCHASE WATER FROM EPWU	2020	WMS SELLER: EL PASO; WMS SUPPLY RECIPIENT: LOWER VALLEY WD																				
LVWD - SURFACE WATER TREATMENT PLANT AND TRANSMISSION LINES	2020	PROJECT SPONSOR(S): LOWER VALLEY WD																				
LVWD - WASTEWATER TREATMENT AND ASR FACILITY	2020	PROJECT SPONSOR(S): LOWER VALLEY WD																				
TOWN OF ANTHONY - ADDITIONAL GROUNDWATER WELL	2020	PROJECT SPONSOR(S): ANTHONY	Yes	2016	2020	Under construction		If other, please describe: Loan agency delays; Bid process difficulties; "Buy American Steel" requirement results in 20% increase in cost of material.	960 ac-ft/yr	$600,000	$1,244,471	2020	No			2045	TWDB - Other	Town capital improvem ent funds.	Yes	No	No	Would be more advantagous to pursue SWIFT funds instead of DWSRF due to less restrictions.

Table 11-8. (continued) 2021 Far West Texas Strategy Implementation Survey

WMS or WMS Project Name	Database Online Decade	Related Sponsor Entity and/or Benefitting WUGs	Has Sponsor taken affirmative vote or actions? (TWC 16.053(h)(10))	If yes, in what year did this occur?	If yes, by what date is the action on schedule for implementation?	At what level of implementation is the project currently?*	If not implemented, why?* (When "If other, please describe" is selected, please add the descriptive text to that field)	What impediments presented to implementation?* (When "If other, please describe" is selected, please add the descriptive text to that field)	Current water supply project yield (ac-ft/yr)	Funds expended to date ($)	Project Cost ($)	Year the project is online?*	Is this a phased project?*	(Phased) Ultimate volume (ac-ft/yr)	(Phased) Ultimate project cost ($)	Year project reaches maximum capacity?*	What is the project funding source(s)?*	Funding Mechanism if Other?	Included in 2021 plan?*	Does the project or WMS involve reallocation of flood control?*	Does the project or WMS provide any measurable flood risk reduction?*	Optional Comments
TOWN OF ANTHONY - ARSENIC TREATMENT FACILITY	2020	PROJECT SPONSOR(S): ANTHONY	Yes	2016	Uncertain	Acquisition and design phase		Access to funding	2,800 ac-ft/yr	$250,000	$10,000,000	2023	Yes	2,800 ac-ft/yr	$10,000,000	2045	TWDB - SWIFT	TWDB other	Yes	No	No	Town will need grant funding to fully implement arsenic treatment in order to keep customer water rates affordable.
TOWN OF ANTHONY - WATER LOSS AUDIT AND MAIN-LINE REPAIR	2020	PROJECT SPONSOR(S): ANTHONY	Yes	2016	Uncertain	Acquisition and design phase		Access to funding	7 ac-ft/yr	$65,000	$1,00,000	2023	No			2045	TWDB - Other	Customer rate increases and taxes.	No	No	No	
EL PASO COUNTY-OTHER - PUBLIC CONSERVATION EDUCATION	2030	WUG REDUCING DEMAND: COUNTY-OTHER, EL PASO																				
EPWU - TREATMENT AND REUSE OF AGRICULTURAL DRAIN WATER	2030	PROJECT SPONSOR(S): EL PASO																				
EPWU - ADVANCED PURIFIED WATER AT THE HASKELL AND NW WWTPS	2040	PROJECT SPONSOR(S): EL PASO																				
EPWU - BRACKISH GROUNDWATER AT THE JONATHAN ROGERS WWTP	2040	PROJECT SPONSOR(S): EL PASO																				
EPWU - GROUNDWATER FROM HUECO RANCH	2040	PROJECT SPONSOR(S): EL PASO																				

Table 11-9. (continued) 2021 Far West Texas Strategy Implementation Survey

WMS or WMS Project Name	Database Online Decade	Related Sponsor Entity and/or Benefitting WUGs	Has Sponsor taken affirmative vote or actions? (TWC 16.053(h)(10))	If yes, in what year did this occur?	If yes, by what date is the action on schedule for implementation?	At what level of implementation is the project currently?*	If not implemented, why?* (When "If other, please describe" is selected, please add the descriptive text to that field)	What impediments presented to implementation?* (When "If other, please describe" is selected, please add the descriptive text to that field)	Current water supply project yield (ac-ft/yr)	Funds expended to date ($)	Project Cost ($)	Year the project is online?*	Is this a phased project?*	(Phased) Ultimate volume (ac-ft/yr)	(Phased) Ultimate project cost ($)	Year project reaches maximum capacity?*	What is the project funding source(s)?*	Funding Mechanism if Other?	Included in 2021 plan?*	Does the project or WMS involve reallocation of flood control?*	Does the project or WMS provide any measurable flood risk reduction?*	Optional Comments
EPWU - GROUNDWATER FROM DIABLO FARMS	2050	PROJECT SPONSOR(S): EL PASO																				
EPWU - GROUNDWATER FROM THE DELL CITY AREA	2060	PROJECT SPONSOR(S): EL PASO																				

11.2 COMPARISON TO PREVIOUS PLAN

The following section includes a summary of how the *2021 Plan* differs from the *2016 Plan*. Comparisons include:

- Water demand projections;
- Drought of record and the hydrologic and modeling assumptions on which the *2021 Plan* is based;
- Source water availability;
- Existing water supplies of WUGs and WWPs;
- WUG and WWP needs; and
- Recommended and alternative water management strategies.

Comparisons include an explanation for the changes that occurred regarding each of the categories.

11.2.1 Water Demand Projections

The following Table 11-2 provides a comparison between *2016 and 2021 Plan* water demand projections by county, while Table 11-3 compares demand projects by water-use category. The overall decrease in water demand in the *2021 Plan* is mostly the result of significantly lower irrigation and manufacturing use projections.

Table 11-2. Water Demand Projections Comparison by County (Acre-Feet/Year)

County	Plan	2020	2030	2040	2050	2060	2070
Brewster	2016	5,192	5,210	5,190	5,181	5,176	5,171
	2021	4,925	4,958	4,950	4,952	4,960	4,966
Culberson	2016	41,461	41,395	40,739	39,664	38,611	37,634
	2021	40,984	41,772	41,953	41,695	41,443	41,250
El Paso	2016	406,422	421,884	430,571	445,175	461,048	476,929
	2021	307,830	324,380	339,295	355,288	371,529	387,190
Hudspeth	2016	180,360	176,653	173,040	169,502	166,032	162,635
	2021	116,959	116,960	116,979	116,996	117,008	117,022
Fort Davis	2016	3,520	3,497	3,475	3,458	3,439	3,425
	2021	1,687	1,677	1,669	1,664	1,664	1,664
Presidio	2016	6,938	6,530	6,533	6,566	6,596	6,625
	2021	6,265	5,953	6,046	6,170	6,287	6,400
Terrell	2016	1,511	1,604	1,556	1,416	1,283	1,178
	2021	1,774	1,877	1,840	1,705	1,582	1,484
Total	**2016**	**645,404**	**656,773**	**661,104**	**670,962**	**682,185**	**693,597**
	2021	**480,424**	**497,577**	**512,732**	**528,470**	**544,473**	**559,976**

Table 11-3. Water Demand Projections Comparison by Water-User Category (Acre-Feet/Year)

Water Use Category	Plan	2020	2030	2040	2050	2060	2070
Municipal	2016	133,761	147,990	161,620	176,250	191,117	205,328
	2021	139,241	153,458	167,131	181,839	196,770	211,047
County-Other	2016	8,057	8,509	8,980	9,545	10,080	10,595
	2021	3,266	4,048	4,760	5,506	6,214	6,885
Manufacturing	2016	16,144	17,271	18,361	19,288	20,764	22,353
	2021	7,033	8,163	8,163	8,163	8,163	8,163
Mining	2016	6,069	7,093	7,863	8,147	8,511	9,066
	2021	7,835	8,859	9,629	9,913	10,277	10,832
Steam Electric Power	2016	6,937	8,111	9,541	11,284	13,410	15,937
	2021	10,545	10,545	10,545	10,545	10,545	10,545
Livestock	2016	2,997	2,997	2,997	2,997	2,997	2,997
	2021	2,101	2,101	2,101	2,101	2,101	2,101
Irrigation	2016	471,439	464,802	451,742	443,451	435,306	427,321
	2021	310,403	310,403	310,403	310,403	310,403	310,403

11.2.2 Drought of Record and Hydrologic and Modeling Assumptions

The **drought of record** consideration for water supply analysis for both the *2016 and 2021 Plans* is the drought of the 1950s. However, the *2016 Plan* does recognize that the current drought conditions as particularly witnessed in the summer of 2011 with a significantly low lake level at Elephant Butte Reservoir and corresponding cutback on irrigation allocations is having a significant impact on local water supply sources. The *2021 Plan* continues to recognize that, compared to the rest of the State, Far West Texas is perennially under drought or near-drought conditions. The *Plan* also recognizes that consistent flows of the Rio Grande of less than 250 cfs below Presidio has detrimental impacts on the local agricultural economy as well as threatens important wildlife habitat.

11.2.3 Source Water Availability

Surface water availability for both the *2016 and 2021 Plans* is based on Run 3 of the TCEQ Water Availability Models (WAMs) for the Rio Grande and Pecos Rivers. Rio Grande flows entering Texas from New Mexico are subject to the requirements set forth in the Rio Grande Compact and administered through the Rio Grande Project.

Groundwater availability in both the *2016 and 2021 Plans* is based on the Modeled Available Groundwater (MAG) volumes that may be produced on an average annual basis to achieve a Desired Future Condition (DFC) as adopted by Groundwater Management Areas (GMAs) (per Texas Water Code §36.001). Groundwater availability volumes for parts of the Region where MAGs are not determined by the TWDB are calculated separately based on science-based aquifer hydrologic characteristics.

Surface water source availability differs between the two *Plans* as a result of an updated running of the WAM. Likewise, changes in groundwater availability results from updated GMA criteria and MAG runs. Compared to 2016 source-supply volumes, 2021 surface water volumes decreased, groundwater volumes decreased, and reuse volumes increased. In total, projected source-supply volumes decreased by approximately nine percent from the *2016 Plan* to the *2021 Plan*. A Source Data Comparison table is provided in the Executive Summary of this *Plan*.

11.2.4 Existing Water Supplies of WUGs and WWPs

A WUG Data Comparison Table is provided in the Executive Summary of this *Plan*, which compares water supplies available to Water User Groups (WUGs) based on the current infrastructure ability of each to obtain water supplies. These abilities primarily include existing infrastructure, water-rights limitations, and groundwater conservation district permit limitations. Municipal WUGs differ between the two Tables due to the change to utility base in the *2021 Plan*.

11.2.5 WUG and MWP Needs

Water supply needs occur when an entity's (WUG's) projected water demand exceeds its supply availability. Table 11-4 and Table 11-5 compare those entities in the *2016 and 2021 Plans* that are projected to experience a water supply need at some decade in the next 50 years. The dramatic difference between WUG needs in the two *Plans* is primarily the result of the decreased source supply availability shown in the *2021 Plan*.

Table 11-4. 2016 WUG and MWP With Needs
(Acre-Feet/Year)

County	2020	2030	2040	2050	2060	2070
Culberson County						
Mining	291	1,025	1,178	895	628	425
El Paso County						
El Paso Water				8,978	19,602	29,792
Fort Bliss	26	40	74	128	178	228
Horizon City	1,352	3,203	4,941	6,669	8,308	9,853
Horizon Regional MUD	1,233	2,582	3,851	5,115	6,317	7,451
Lower Valley Water District	2,453	3,228	3,965	4,734	5,500	6,227
Socorro	217	488	757	1,069	1,406	1,732
County Other	368	764	1,220	1,754	2,259	2,745
Manufacturing	8,841	9,968	11,058	11,985	13,461	15,050
Mining				242	987	1,833
Steam Electric Power	3,651	4,825	6,255	7,998	10,124	12,651
Irrigation	75,165	71,278	60,950	55,026	50,512	46,834
Hudspeth County						
Mining				2	11	21
Irrigation	94,847	91,139	87,508	83,952	80,470	77,060
Terrell County						
Mining	449	552	516	382	259	161

Table 11-5. 2021 WUG and MWP With Needs
(Acre-Feet/Year)

County	2020	2030	2040	2050	2060	2070
Culberson County						
Irrigation	333	333	5,858	5,858	5,858	5,858
El Paso County						
El Paso Water				8,978	19,6018	29,792
Horizon Regional MUD	2,709	5,816	8,735	11,641	14,403	17,008
Lower Valley Water District	1,358	2,207	3,042	3,934	4,833	5,689
County-Other | Vinton Hills Estates				4	24	42
County-Other | Vinton Hills Subdivision				10	54	96
Manufacturing		860	860	860	860	860
Mining	1,851	2,469	3,105	3,791	4,536	5,382
Steam Electric Power	7,260	7,260	7,260	7,260	7,260	7,260
Irrigation	46,404	46,404	46,404	46,404	46,404	46,404
Hudspeth County						
County-Other	35	38	38	38	38	39
Mining	196	168	185	200	209	219
Terrell County						
Mining	483	586	550	416	293	195

11.2.6 Recommended and Alternate Water Management Strategies and Projects

A total of 63 recommended and one alternate water management strategies (Table 11-6) for 30 water user groups (WUGs) occur in the *2016 Plan*, with a total capital cost of $1,903,771,872. The *2021 Plan* contains a total of 48 recommended and 10 alternate strategies (Table 11-7) for 24 WUGs with a total capital cost of $2,110,409,105.

Tables 11-8 and 11-9 provide similar comparisons between 2016 and 2021 strategy projects. The *2016 Plan* contains 46 projects for 22 WUGs and the *2021 Plan* lists 49 strategy projects for 22 WUGs.

Table 11-6. Summary of 2016 Plan Recommended Water Management Strategies and Projects
(Acre-Feet per Year)

County	Water User Group	Strategy	Strategy ID	Strategy Supply (Acre-Feet/Year)						Total Capital Cost
				2020	2030	2040	2050	2060	2070	
Brewster	Brewster County-Other Marathon WSSService	Water loss audit and main-line repair	E-1	40	40	40	40	40	40	$265,000
	Brewster County-Other Rio Grande Village BBNP	Water loss audit and main-line repair	E-2	6	6	6	6	6	6	$616,000
Culberson	*Culberson County Mining	Additional groundwater wells	E-3	590	590	590	590	590	590	$608,000
		Additional groundwater well	E-4	590	590	590	590	590	590	$675,000
El Paso	*City of Anthony	Public conservation education	E-5	7	9	10	11	12	13	$0
		Arsenic treatment facility	E-6	2,800	2,800	2,800	2,800	2,800	2,800	$9,952,000
	*City of El Paso (EPWU)	Municipal conservation programs	E-7	1,870	2,110	1,160	2,550	5,530	5,910	$0
		Advanced purified water at the Haskell and NW WWTPs	E-8	3,000	7,500	12,000	16,500	21,000	24,000	$395,241,000
		Advanced purified water at the Bustamante WWTP	E-9	8,000	9,000	10,000	10,000	10,000	10,000	$94,096,000
		Recharge of Hueco Aquifer groundwater with treated surface water from Jonathan Rogers Plant	E-10	5,000	5,000	5,000	5,000	5,000	5,000	$1,800,000
		Treatment & reuse of agricultural drain water	E-11		8,100	8,100	8,100	8,100	8,100	$125,000,000

Table 11-6. (Continued) Summary of 2016 Plan Recommended Water Management Strategies and Projects
(Acre-Feet per Year)

County	Water User Group	Strategy	Strategy ID	Strategy Supply (Acre-Feet/Year)						Total Capital Cost
				2020	2030	2040	2050	2060	2070	
El Paso	*City of El Paso (EPWU)	Expansion of local well fields	E-12	3,880	7,760	11,640	15,520	19,400	23,280	$32,712,000
		Brackish Groundwater at the Jonathan Rogers WTP	E-13	11,000	11,000	11,000	11,000	11,000	11,000	$65,924,000
		Expansion of the Kay Bailey Hutchinson Desal Plant	E-14	1,260	2,520	2,520	2,520	2,520	2,520	$37,200,000
		Groundwater from Hueco Ranch	E-15			5,000	5,000	5,000	5,000	$156,000,000
		Groundwater from Southern Hudspeth County	E-16	10,000	10,000	10,000	10,000	10,000	10,000	$98,980,000
		Expansion of the Jonathan Rogers WTP	E-17	6,500	6,500	6,500	6,500	6,500	6,500	$95,186,653
		Riverside Regulating Reservoir	E-18	1,500	1,500	1,500	1,500	1,500	1,500	$93,526,200
		Groundwater from Diablo Farms	E-19				10,000	10,000	10,000	$273,507,000
		Groundwater from Dell City area	E-20					10,000	20,000	$257,901,000
	*Lower Valley Water District	Public conservation education	E-21	36	43	51	59	66	73	$0
		Purchased water from EPWU	E-22	4,356	4,356	4,356	4,356	4,356	4,356	0
	*City of Socorro	Public conservation education	E-23	32	34	37	40	44	47	$0
		Purchased water from LVWD	E-24	2,959	2,959	2,959	2,959	2,959	2,959	$0
	*Horizon City	Public conservation education	E-25	45	63	80	98	114	130	$0
		Purchased water from Horizon MUD	E-26	3,106	3,106	3,106	3,106	3,106	3,106	$0
	*Horizon Regional MUD	Public conservation education	E-27	37	50	63	76	88	99	$0
		Additional wells & expansion of desal plant	E-28							

Table 11-6. (Continued) Summary of 2016 Plan Recommended Water Management Strategies and Projects
(Acre-Feet per Year)

County	Water User Group	Strategy	Strategy ID	Strategy Supply (Acre-Feet/Year)						Total Capital Cost
				2020	2030	2040	2050	2060	2070	
El Paso	*Fort Bliss	Public conservation education	E-29	16	17	17	18	18	19	$0
El Paso	*Fort Bliss	Purchased water from EPWU	E-30	435	435	435	435	435	435	$0
El Paso	El Paso County Tornillo WID	Additional groundwater well & transmission line	E-31	333	333	333	333	333	333	$1,726,000
El Paso	El Paso County Tornillo WID	Arsenic treatment facility	E-32	276	276	276	276	276	276	$3,114,000
El Paso	City of Vinton	High capacity water lines for improved distribution of water from EPWU	E-33	400	400	400	400	400	400	$4,192,000
El Paso	*El Paso County Other	Purchased water from EPWU	E-34	6,278	6,278	6,278	6,278	6,278	6,278	$0
El Paso	*El Paso County Irrigation (EPCWID #1)	Irrigation scheduling	E-35	1,740	1,740	1,740	1,740	1,740	1,740	$0
El Paso	*El Paso County Irrigation (EPCWID #1)	Tailwater reuse	E-36	1,723	1,723	1,723	1,723	1,723	1,723	$0
El Paso	*El Paso County Irrigation (EPCWID #1)	Improvements to water district delivery system	E-37	25,000	25,000	25,000	25,000	25,000	25,000	$157,777,783
El Paso	*El Paso County Manufacturing	Purchased water from EPWU	E-38	7,297	7,297	7,297	7,297	7,297	7,297	$0
El Paso	*El Paso County Mining	Additional groundwater wells	E-39	1,840	1,840	1,840	1,840	1,840	1,840	$969,000
El Paso	*El Paso County Steam Electric Power	Purchased water from EPWU	E-40	3,286	3,286	3,286	3,286	3,286	3,286	$0
Hudspeth	Hudspeth County Other (Dell City)	Water loss audit and main-line repair	E-41	1	1	1	1	1	1	$120,000
Hudspeth	Hudspeth County Other (Dell City)	Brackish groundwater desal facility	E-42	111	111	111	111	111	111	$1,299,000
Hudspeth	Hudspeth County Other (Fort Hancock WCID)	Water loss audit and main-line repair	E-43	2	2	2	2	2	2	$265,000

Table 11-6. (Continued) Summary of 2016 Plan Recommended Water Management Strategies and Projects
(Acre-Feet per Year)

County	Water User Group	Strategy	Strategy ID	Strategy Supply (Acre-Feet/Year)						Total Capital Cost
				2020	2030	2040	2050	2060	2070	
Hudspeth	Hudspeth County Other (Fort Hancock WCID)	Additional well & RO treatment facility	E-44	565	565	565	565	565	565	$6,109,000
	Hudspeth County Other (City of Sierra Blanca) Hudspeth Co. WCID #1	Additional transmission line to supply connections outside of the District	E-45	351	351	351	351	351	351	$1,429,000
	*Hudspeth Irrigation (HCCRD #1)	Additional groundwater wells	E-46	230	230	230	230	230	230	$173,000
	Hudspeth Irrigation (HCUWCD #1)	Irrigation scheduling	E-47	3,535	3,535	3,535	3,535	3,535	3,535	$0
		Tailwater reuse	E-48	589	589	589	589	589	589	$0
	*Hudspeth County Mining	Additional groundwater well	E-49	30	30	30	30	30	30	$449,000
Jeff Davis	Fort Davis WSC	Additional groundwater well	E-50	274	274	274	274	274	274	$507,000
		Additional transmission line to connect Fort Davis WSC to Fort Davis Estates	E-51	114	114	114	114	114	114	$1,068,000
Presidio	City of Marfa	Additional groundwater well	E-52	785	785	785	785	785	785	$1,143,000
	City of Presidio	Water supply for the City of Presidio	E-53							
Terrell	*Terrell County Mining	Additional groundwater wells	E-54	560	560	560	560	560	560	$738,000

Table 11-7. Summary of 2021 Plan Recommended and Alternate Water Management Strategies
(Acre-Feet per Year)

County	Water User Group	Strategy	Strategy ID	Strategy Supply (Acre-Feet/Year)						Total Capital Cost (Table 5-3)
				2020	2030	2040	2050	2060	2070	
Brewster	City of Alpine	Modification to wastewater treatment facility & irrigation system	E-1		25	25	25	25	25	$2,318,000
		Irrigation and recharge application of captured rainwater runoff	E-2		70	70	70	70	70	$1,296,000
	Marathon WSSService	Water loss audit and main-line repair	E-3	12	12	12	12	12	12	$255,000
	Lajitas Municipal Services	Water loss audit and main-line repair	E-4	51	51	51	51	51	51	$2,545,000
	Brewster County Other (Study Butte Terlingua WS)	Water loss audit and main-line repair	E-5	25	25	25	25	25	25	$3,054,000
Culberson	*Culberson County Irrigation	Irrigation scheduling	E-6	107	107	107	107	107	107	$0
		Additional groundwater wells	E-7	333	333	333	333	333	333	$510,000
El Paso	Town of Anthony	Arsenic treatment facility	E-8	2,800	2,800	2,800	2,800	2,800	2,800	$10,334,000
		Additional groundwater well	E-9	960	960	960	960	960	960	$1,913,000
	*El Paso Water	Municipal conservation programs	E-10	4,950	5,530	5,080	9,940	13,140	17,820	$1,070,000
		Advanced water purification at the Bustamante WWTP	E-11	8,500	9,200	9,900	10,600	10,600	10,600	$100,361,400
		Hueco Bolson artificial recharge	E-14		5,000	5,000	5,000	5,000	5,000	$38,003,000
		Groundwater from Dell City Area (Phase 1)	E-16			4,475	4,475	4,475	4,475	$569,357,000

Table 11-7. (continued) Summary of 2021 Plan Recommended and Alternate Water Management Strategies (Acre-Feet per Year)

County	Water User Group	Strategy	Strategy ID	Strategy Supply (Acre-Feet/Year)						Total Capital Cost (Table 5-3)
				2020	2030	2040	2050	2060	2070	
El Paso	*El Paso Water	Groundwater from Dell City Area (Phase 2)	E-17				10,000	10,000	10,000	$320,226,000
	*El Paso Water ALTERNATE STRATEGIES	Treatment and reuse of agricultural drain water	E-18			2,700	2,700	2,700	2,700	$21,466,000
		Expansion of the Kay Bailey Hutchison Desal Plant	E-13					5,000	5,000	$26,490,000
		Expansion of Canutillo Mesilla Bolson Well Field	E-19		7,760	11,640	15,520	19,400	23,280	$6,444,000
		Riverside Regulating Reservoir	E-15			3,250	3,250	3,250	3,250	$6,754,036
		Lower Valley well head RO	E-20			5,000	5,000	5,000	5,000	$52,681,000
		Expansion of Jonathan Rogers WTP	E-21			6,500	6,500	6,500	6,500	$88,679,000
		Conjunctive treatment of groundwater and surface water at the Upper Valley WWTP	E-22		10,000	10,000	10,000	10,000	10,000	$72,873,000
		Advanced water purification at the Haskell Street RWP	E-12						10,000	$189,356,000
		Advanced water purification at the Fred Hervey WWTP	E-23			10,000	10,000	10,000	10,000	$140,394,000
	*Lower Valley Water District	Public conservation education	E-24	57	66	74	83	92	100	$0
		Purchase water from EPW	E-26	1,344	2,185	3,012	3,895	4,785	5,632	$0
		Surface water treatment plant & transmission line	E-27		5,000	5,000	5,000	5,000	5,000	$74,338,000

Table 11-7. (continued) Summary of 2021 Plan Recommended and Alternate Water Management Strategies
(Acre-Feet per Year)

County	Water User Group	Strategy	Strategy ID	Strategy Supply (Acre-Feet/Year)						Total Capital Cost (Table 5-3)
				2020	2030	2040	2050	2060	2070	
El Paso	*Lower Valley Water District	Groundwater from proposed Well field	E-28		6,800	6,800	6,800	6,800	6,800	$39,236,000
		Groundwater from proposed Well field	E-29		6,800	6,800	6,800	6,800	6,800	$36,110,000
		Wastewater treatment facility and ASR	E-30		5,589	5,589	5,589	5,589	5,589	$23,509,000
	*Horizon Regional MUD	Water loss audit and main-line repair	E-31	197	274	346	418	487	551	$255,000
		Public conservation education	E-32	79	110	140	169	196	222	$0
		Additional wells & expansion of desalination plant	E-33	16,786	16,786	16,786	16,786	16,786	16,786	$71,809,000
	Haciendas Del Norte WID	Water loss audit and main-line repair	E-34	12	13	15	16	17	19	$764,000
	East Montana WS	Water loss audit and main-line repair	E-35	41	46	50	54	59	63	$1,018,000
	El Paso County Tornillo WID	Additional groundwater well & transmission line	E-36	333	333	333	333	333	333	$2,060,000
	*El Paso County Other (Vinton Hills)	Public conservation education	E-37	0	0	0	4	5	5	$0
		Purchase water from EPW	E-38				10	73	133	$0
	*El Paso County Irrigation (EPCWID #1)	Irrigation scheduling	E-40	1,740	1,740	1,740	1,740	1,740	1,740	$102,595
		Tailwater reuse	E-41	1,723	1,723	1,723	1,723	1,723	1,723	$973,368

Table 11-7. (continued) Summary of 2021 Plan Recommended and Alternate Water Management Strategies (Acre-Feet per Year)

County	Water User Group	Strategy	Strategy ID	Strategy Supply (Acre-Feet/Year)						Total Capital Cost (Table 5-3)
				2020	2030	2040	2050	2060	2070	
El Paso	*El Paso County Irrigation (EPCWID #1)	Improvements to water district delivery system	E-42	25,000	25,000	25,000	25,000	25,000	25,000	$157,777,783
El Paso	*El Paso County Irrigation (EPCWID #1)	Riverside Regulating Reservoir	E-43		3,250	3,250	3,250	3,250	3,250	$6,754,036
El Paso	*El Paso County Irrigation (EPCWID #1)	New Wasteway 32 River Diversion Pumping Point	E-44	5,000	5,000	5,000	5,000	5,000	5,000	$4,055,887
El Paso	*El Paso County Manufacturing	Purchase water from EPW	E-46		860	860	860	860	860	$0
El Paso	*El Paso County Mining	Additional groundwater wells	E-48	4,251	4,251	4,251	4,251	4,251	4,251	$1,208,000
El Paso	*El Paso County Steam Electric Power	Purchase water from EPW	E-50	7,260	7,260	7,260	7,260	7,260	7,260	$0
Hudspeth	Hudspeth County Other (Dell City)	Brackish groundwater desal facility	E-51		111	111	111	111	111	$1,636,000
Hudspeth	*Hudspeth County Other (City of Sierra Blanca - Hudspeth Co. WCID #1)	Public conservation education	E-52	1	2	2	2	2	2	$0
Hudspeth	*Hudspeth County Other (City of Sierra Blanca - Hudspeth Co. WCID #1)	Replace water-supply line from Van Horn	E-53		39	39	39	28	0	$18,432,000
Hudspeth	*Hudspeth County Other (City of Sierra Blanca - Hudspeth Co. WCID #1)	Local groundwater well	E-54	16	16	16	16	16	16	$940,000
Hudspeth	*Hudspeth County Other (City of Sierra Blanca - Hudspeth Co. WCID #1)	Groundwater well NE of Van Horn	E-55	39	39	39	39	39	0	$2,132,000
Hudspeth	*Hudspeth County Other (City of Sierra Blanca - Hudspeth Co. WCID #1)	Groundwater well West of Van Horn	E-56	39	39	39	39	39	39	$636,000
Hudspeth	*Hudspeth County Mining	Additional groundwater well	E-58	219	219	219	219	219	219	$306,000

Table 11-7. (continued) Summary of 2021 Plan Recommended and Alternate Water Management Strategies
(Acre-Feet per Year)

County	Water User Group	Strategy	Strategy ID	Strategy Supply (Acre-Feet/Year)						Total Capital Cost (Table 5-3)
				2020	2030	2040	2050	2060	2070	
Jeff Davis	Fort Davis WSC	Additional groundwater well	E-59	274	274	274	274	274	274	$584,000
		Transmission line to connect Fort Davis WSC to Fort Davis Estates	E-60		114	114	114	114	114	$1,671,000
	Jeff Davis County Other (Town of Valentine)	Additional groundwater well	E-61	129	129	129	129	129	129	$783,000
Presidio	City of Presidio	Water loss audit and main-line repair	E-62	35	37	38	41	43	45	$509,000
		Additional groundwater well	E-63	120	120	120	120	120	120	$5,509,000
Terrell	*Terrell County Mining ALTERNATE STRATEGY	Additional groundwater wells	E-65	470	470	470	470	470	470	$921,000

Table 11-8. Summary of 2016 Plan Recommended and Alternate Water Management Projects
(Acre-Feet per Year)

County	Water User Group	Strategy	2016 Strategy ID	Strategy Supply (Acre-Feet/Year)						Total Capital Cost (Table 5-3)
				2020	2030	2040	2050	2060	2070	
Brewster	Brewster County Other (Marathon WSSService)	Water loss audit and main-line repair	E-1	65	65	65	65	65	65	$426,000
	Brewster County Other (Rio Grande Village BBNP)	Water loss audit and main-line repair	E-2	6	6	6	6	6	6	$607,000
	Brewster County Other (Panther Junction BBNP Plt)	Water loss audit and main-line repair	E-3	2	2	2	2	2	2	$759,000
Culberson	City of Van Horn	Water loss audit and main-line repair	E-4	30	30	30	30	30	30	$1,197,000
	*Culberson County Mining	Additional groundwater wells	E-5	590	590	590	590	590	590	$608,000
		Additional groundwater well	E-6	590	590	590	590	590	590	$675,000
El Paso	*Town of Anthony	Water loss audit and main-line repair	E-7	7	7	7	7	7	7	$759,000
		Arsenic treatment facility	E-8	2,800	2,800	2,800	2,800	2,800	2,800	$9,952,000
		Additional groundwater well	E-9	960	960	960	960	960	960	$1,244,471
	*City of El Paso (EPWU)	Advanced purified water at the Haskell and NW WWTPs	E-11			3,000	7,500	12,000	16,500	$291,800,000
		Advanced purified water at the Bustamante WWTP	E-12	8,000	9,000	10,000	10,000	10,000	10,000	$94,096,000
		Recharge of Hueco Aquifer groundwater with treated surface water from Jonathan Rogers Plant	E-13	5,000	5,000	5,000	5,000	5,000	5,000	$2,495,000
		Treatment & reuse of agricultural drain water	E-14		2,700	2,700	2,700	2,700	2,700	$41,679,000
		Expansion of local well fields	E-15	3,880	7,760	11,640	15,520	19,400	23,280	$32,712,000
		Brackish Groundwater at the Jonathan Rogers WTP	E-16			11,000	11,000	11,000	11,000	$65,865,000
		Expansion of the Kay Bailey Hutchison Desal Plant	E-17	1,260	2,520	2,520	2,520	2,520	2,520	$37,200,000

Table 11-8. (continued) Summary of 2016 Plan Recommended and Alternate Water Management Projects
(Acre-Feet per Year)

County	Water User Group	Strategy	2016 Strategy ID	Strategy Supply (Acre-Feet/Year)						Total Capital Cost (Table 5-3)
				2020	2030	2040	2050	2060	2070	
El Paso	*City of El Paso (EPWU)	Groundwater from Hueco Ranch	E-18			5,000	5,000	5,000	5,000	$155,858,000
		Groundwater from Southern Hudspeth County	E-19	10,000	10,000	10,000	10,000	10,000	10,000	$98,980,000
		Expansion of the Jonathan Rogers WTP	E-20	6,500	6,500	6,500	6,500	6,500	6,500	$95,186,653
		Riverside Regulating Reservoir	E-21	6,500	6,500	6,500	6,500	6,500	6,500	$20,754,157
		Groundwater from Diablo Farms	E-22				10,000	10,000	10,000	$273,507,000
		Groundwater from Dell City area	E-23					10,000	20,000	$303,185,000
	*Lower Valley Water District	Surface water treatment plant & transmission line	E-26	6,700	6,700	6,700	6,700	6,700	6,700	$34,080,000
		Groundwater from proposed Well field	E-27	6,800	6,800	6,800	6,800	6,800	6,800	$37,490,000
		Groundwater from proposed Well field	E-28	6,800	6,800	6,800	6,800	6,800	6,800	$41,070,000
		Wastewater treatment facility and ASR	E-29	3,808	3,808	3,808	3,808	3,808	3,808	$18,108,000
	*Horizon Regional MUD	Additional wells & expansion of desal plant	E-35	2,585	5,785	8,792	11,784	14,625	17,304	$56,443,000
	El Paso County Tornillo WID	Additional groundwater well & transmission line	E-38	333	333	333	333	333	333	$1,726,000
		Arsenic treatment facility	E-39	276	276	276	276	276	276	$3,114,000
	City of Vinton	High capacity water lines for improved distribution of water from EPWU	E-40	400	400	400	400	400	400	$4,192,000
		Improvements to water district delivery system	E-45	25,000	25,000	25,000	25,000	25,000	25,000	$157,777,783
	*El Paso County Mining	Additional groundwater wells	E-47				242	987	1,833	$969,000
Hudspeth	Hudspeth County Other (Dell City)	Water loss audit and main-line repair	E-49	1	1	1	1	1	1	$1,614,000
		Brackish groundwater desal facility	E-50	111	111	111	111	111	111	$1,299,000

Table 11-8. (continued) Summary of 2016 Plan Recommended and Alternate Water Management Projects
(Acre-Feet per Year)

County	Water User Group	Strategy	2016 Strategy ID	Strategy Supply (Acre-Feet/Year)						Total Capital Cost (Table 5-3)
				2020	2030	2040	2050	2060	2070	
Hudspeth	Hudspeth County Other (Fort Hancock WCID)	Water loss audit and main-line repair	E-51	3	3	3	3	3	3	$292,000
		Additional well & RO treatment facility	E-52	565	565	565	565	565	565	$6,109,000
	Hudspeth County Other (City of Sierra Blanca - Hudspeth Co. WCID #1)	Additional transmission line to supply connections outside of the District	E-53	351	351	351	351	351	351	$1,429,000
	*Hudspeth Irrigation (HCCRD #1)	Additional groundwater wells	E-54	230	230	230	230	230	230	$173,000
	*Hudspeth County Mining	Additional groundwater well	E-57	30	30	30	30	30	30	$449,000
Jeff Davis	Fort Davis WSC	Additional groundwater well	E-58	274	274	274	274	274	274	$507,000
		Additional transmission line to connect Fort Davis WSC to Fort Davis Estates	E-59	114	114	114	114	114	114	$1,068,000
	Jeff Davis County Other (Town of Valentine)	Additional groundwater well	E-60	65	65	65	65	65	65	$402,808
Presidio	City of Marfa	Additional groundwater well	E-61	785	785	785	785	785	785	$1,143,000
	City of Presidio	Water loss audit and main-line repair	E-62	9	9	9	9	9	9	$2,172,000
		Additional groundwater well	E-63	120	120	120	120	120	120	$1,861,000
Terrell	*Terrell County Mining	Additional groundwater wells	E-64	0	0	0	0	0	0	$738,000

Table 11-9. Summary of 2021 Plan Recommended and Alternate Water Management Projects
(Acre-Feet per Year)

County	Water User Group	Strategy	Strategy ID	Strategy Supply (Acre-Feet/Year)						Total Capital Cost (Table 5-3)
				2020	2030	2040	2050	2060	2070	
Brewster	City of Alpine	Modification to wastewater treatment facility & irrigation system	E-1		25	25	25	25	25	$2,318,000
		Irrigation and recharge application of captured rainwater runoff	E-2		70	70	70	70	70	$1,296,000
	Marathon WSSService	Water loss audit and main-line repair	E-3	12	12	12	12	12	12	$255,000
	Lajitas Municipal Services	Water loss audit and main-line repair	E-4	51	51	51	51	51	51	$2,545,000
	Brewster County Other (Study Butte Terlingua WS)	Water loss audit and main-line repair	E-5	25	25	25	25	25	25	$3,054,000
Culberson	*Culberson County Irrigation	Additional groundwater wells	E-7	333	333	333	333	333	333	$510,000
El Paso	Town of Anthony	Arsenic treatment facility	E-8	2,800	2,800	2,800	2,800	2,800	2,800	$10,334,000
		Additional groundwater well	E-9	960	960	960	960	960	960	$1,913,000
	*El Paso Water	Municipal conservation programs	E-10	4,950	5,530	5,080	9,940	13,140	17,820	$1,070,000
		Advanced water purification at the Bustamante WWTP	E-11	8,500	9,200	9,900	10,600	10,600	10,600	$100,361,400
		Hueco Bolson artificial recharge	E-14		5,000	5,000	5,000	5,000	5,000	$38,003,000
		Groundwater from Dell City Area (Phase 1)	E-16			4,475	4,475	4,475	4,475	$569,357,000

Table 11-9. (continued) Summary of 2021 Plan Recommended and Alternate Water Management Projects
(Acre-Feet per Year)

County	Water User Group	Strategy	Strategy ID	Strategy Supply (Acre-Feet/Year)						Total Capital Cost (Table 5-3)
				2020	2030	2040	2050	2060	2070	
El Paso	*El Paso Water	Groundwater from Dell City Area (Phase 2)	E-17				10,000	10,000	10,000	$320,226,000
El Paso	*El Paso Water ALTERNATE STRATEGIES	Treatment and reuse of agricultural drain water	E-18			2,700	2,700	2,700	2,700	$21,466,000
El Paso	*El Paso Water ALTERNATE STRATEGIES	Expansion of the Kay Bailey Hutchison Desal Plant	E-13					5,000	5,000	$26,490,000
El Paso	*El Paso Water ALTERNATE STRATEGIES	Expansion of Canutillo Mesilla Bolson Well Field	E-19		7,760	11,640	15,520	19,400	23,280	$6,444,000
El Paso	*El Paso Water ALTERNATE STRATEGIES	Riverside Regulating Reservoir	E-15			3,250	3,250	3,250	3,250	$6,754,036
El Paso	*El Paso Water ALTERNATE STRATEGIES	Lower Valley well head RO	E-20			5,000	5,000	5,000	5,000	$52,681,000
El Paso	*El Paso Water ALTERNATE STRATEGIES	Expansion of Jonathan Rogers WTP	E-21			6,500	6,500	6,500	6,500	$88,679,000
El Paso	*El Paso Water ALTERNATE STRATEGIES	Conjunctive treatment of groundwater and surface water at the Upper Valley WWTP	E-22		10,000	10,000	10,000	10,000	10,000	$72,873,000
El Paso	*El Paso Water ALTERNATE STRATEGIES	Advanced water purification at the Haskell Street RWP	E-12						10,000	$189,356,000
El Paso	*El Paso Water ALTERNATE STRATEGIES	Advanced water purification at the Fred Hervey WWTP	E-23			10,000	10,000	10,000	10,000	$140,394,000
El Paso	*Lower Valley Water District	Surface water treatment plant & transmission line	E-27		5,000	5,000	5,000	5,000	5,000	$74,338,000
El Paso	*Lower Valley Water District	Groundwater from proposed Well field	E-28		6,800	6,800	6,800	6,800	6,800	$39,236,000
El Paso	*Lower Valley Water District	Groundwater from proposed Well field	E-29		6,800	6,800	6,800	6,800	6,800	$36,110,000

Table 11-9. (continued) Summary of 2021 Plan Recommended and Alternate Water Management Projects (Acre-Feet per Year)

County	Water User Group	Strategy	Strategy ID	Strategy Supply (Acre-Feet/Year)						Total Capital Cost (Table 5-3)
				2020	2030	2040	2050	2060	2070	
El Paso	*Lower Valley Water District	Wastewater treatment facility and ASR	E-30		5,589	5,589	5,589	5,589	5,589	$23,509,000
	*Horizon Regional MUD	Water loss audit and main-line repair	E-31	197	274	346	418	487	551	$255,000
		Additional wells & expansion of desalination plant	E-33	16,786	16,786	16,786	16,786	16,786	16,786	$71,809,000
	Haciendas Del Norte WID	Water loss audit and main-line repair	E-34	12	13	15	16	17	19	$764,000
	East Montana WS	Water loss audit and main-line repair	E-35	41	46	50	54	59	63	$1,018,000
	El Paso County Tornillo WID	Additional groundwater well & transmission line	E-36	333	333	333	333	333	333	$2,060,000
	*El Paso County Irrigation (EPCWID #1)	Irrigation scheduling	E-40	1,740	1,740	1,740	1,740	1,740	1,740	$102,595
		Tailwater reuse	E-41	1,723	1,723	1,723	1,723	1,723	1,723	$973,368
		Improvements to water district delivery system	E-42	25,000	25,000	25,000	25,000	25,000	25,000	$157,777,783
		Riverside Regulating Reservoir	E-43		3,250	3,250	3,250	3,250	3,250	$6,754,036
		New Wasteway 32 River Diversion Pumping Point	E-44	5,000	5,000	5,000	5,000	5,000	5,000	$4,055,887
	*El Paso County Mining	Additional groundwater wells	E-48	4,251	4,251	4,251	4,251	4,251	4,251	$1,208,000
Hudspeth	Hudspeth County Other (Dell City)	Brackish groundwater desal facility	E-51		111	111	111	111	111	$1,636,000

Table 11-9. (continued) Summary of 2021 Plan Recommended and Alternate Water Management Projects (Acre-Feet per Year)

County	Water User Group	Strategy	Strategy ID	Strategy Supply (Acre-Feet/Year)						Total Capital Cost (Table 5-3)
				2020	2030	2040	2050	2060	2070	
Hudspeth	*Hudspeth County Other (City of Sierra Blanca Hudspeth Co. WCID #1)	Replace water-supply line from Van Horn	E-53		39	39	39	28	0	$18,432,000
		Local groundwater well	E-54	16	16	16	16	16	16	$940,000
		Groundwater well NE of Van Horn	E-55	39	39	39	39	39	0	$2,132,000
		Groundwater well West of Van Horn	E-56	39	39	39	39	39	39	$636,000
	*Hudspeth County Mining	Additional groundwater well	E-58	219	219	219	219	219	219	$306,000
Jeff Davis	Fort Davis WSC	Additional groundwater well	E-59	274	274	274	274	274	274	$584,000
		Transmission line to connect Fort Davis WSC to Fort Davis Estates	E-60		114	114	114	114	114	$1,671,000
	Jeff Davis County Other (Town of Valentine)	Additional groundwater well	E-61	129	129	129	129	129	129	$783,000
Presidio	City of Presidio	Water loss audit and main-line repair	E-62	35	37	38	41	43	45	$509,000
		Additional groundwater well	E-63	120	120	120	120	120	120	$5,509,000
Terrell	*Terrell County Mining ALTERNATE STRATEGY	Additional groundwater wells	E-65	470	470	470	470	470	470	$921,000

11.3 PROGRESS OF REGIONALIZATION

Six of the seven counties that comprise Far West Texas are highly rural with each county containing only one or two communities of significant size. Generally, these rural communities are totally self-supportive without need or justification for regional / shared water supply projects. The one variable in this scenario is the shared supply between the communities of Van Horn and Sierra Blanca.

Sierra Blanca (Hudspeth County WCID #1) 40 miles to the west of Van Horn has yet to locate and develop a local water supply and has historically relied on groundwater from the Wild Horse Flat (West Texas Bolsons) aquifer in the same well-field region as Van Horn's well-field. Van Horn has assisted Sierra Blanca by transporting water from this shared well-field to a pipeline that moves the water to Sierra Blanca. While this arrangement has worked adequately in the past, the community of Sierra Blanca is motivated to become less reliant on the existing groundwater supply from the Wild Horse Flat aquifer by attempting to locate and develop a supply source closer to town. This *2021 Far West Texas Water Plan* provides strategy recommendations for both enhancing the existing water-supply source and repairing the transmission pipeline, as well as addressing the search for a water source that is less dependent on Van Horn.

The greatest population density in the Region occurs in El Paso County (97 percent of total regional population) along the Rio Grande corridor, with El Paso Water (EPW) providing 77 percent of the water to this area of rapid population expansion. Thus, regionalization has been and will continue to be an important aspect of water-management planning. EPW provides water to the City of El Paso and to six other communities including Fort Bliss military reservation and to the Lower Valley Water District (LVWD). EPW also provides water to manufacturing, steam-electric, mining, and numerous colonias in the County. To meet the growing water-supply needs for EPW's service area, the utility plans to maximize local sources and eventually import additional supplies from the Dell City area.

Regionalization begins with the cooperative agreements between EPW and the El Paso County Water Improvement District #1 (EPCWID#1) that controls almost all the Rio Grande water rights in the County primarily for irrigation use. Shared projects and agreements allow a portion of Rio Grande supply to be used for municipal supply, while the irrigation district makes use of return flows. The LVWD currently receives all its treated water supply from EPW and in turn redirects this water to its own customers.

Another regional cooperative project occurs with the Kay Bailey Hutchison Desalination Facility between EPW and Fort Bliss. Project facilities, including brackish groundwater source wells, treatment plant, and disposal wells, are located on Fort Bliss property, while EPW owns and maintains the facility. Fort Bliss receives a large portion of their supply needs from this project, while EPW is provided with a drought-proof resource to blend in with their other supply sources.

Regionalization thus plays a key role in moving both surface water and groundwater supplies to the numerous end-users in the County. This *2021 Far West Texas Water Plan* continues to support regionalization by recognizing that future water supplies can best be shared in this desert community through cooperative management.

The FWTWPG would like to offer another perspective on regionalization. Participants in the FWTWPG continue to maintain a robust regional relationship by helping affected water systems become sustainable and resilient. However, funding policies may impede this effort by suggesting regionalization through consolidation of water districts. The FWPWPG finds that entities in unserved or underserved areas should still be eligible for financial assistance. The grant or loan eligibility and need to the unserved or underserved service area should be treated independently from the provider of some services through the interlocal agreements. This perspective is further discussed in Recommendation Chapter 8, Section 8.1, Number 5.